

XX. *A Letter from Dr. John Lining, at Charles-Town in South Carolina, to James Jurin, M. D. Coll. Med. & Reg. Soc. Sodal. serving to accompany some Additions to his Statical Experiments printed in N<sup>o</sup>. 470. of these Transactions.*

*South Carolina, Charles-Town, Jan. 29. 1743.*

S I R,

Read March 21.  
1744-5.

**A**S you did me the Honour to communicate to the *Royal Society* the Tables which I sent you some time ago, and since some Excerptions from them have been published in the *Transactions* of that illustrious *Society*, N<sup>o</sup> 470. I have taken the Liberty to send you the inclosed Papers; which, being more complete, I hope will be acceptable.

The first second and third Tables \* are the same with what I sent you at first, [Printed *ibid.* TAB. I. p. 502. & TAB IV. p. 506, 507.]: And in the third I have supposed the *Ingesta* each Month to be 3000 Ounces, to coincide with two Columns in my *Sanc-torian* Tables, where I have daily supposed the *Ingesta* to be 100 Ounces. [This answers to TAB. V. *ibid.* p. 505. but I shall here give it anew, p. 321. *infra*]

The mean Quantities contained in the fifth Table, [p. 323. *infra*] were obtained by a tedious operose Calculation; namely, by calculating each Day's mean diurnal and nocturnal Urine and Perspiration of one Hour in every

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\* Therefore omitted here.

every Month; and by dividing the Sum of each Month's mean diurnal Perspiration, &c. by the Number of Days in each Month. The mean diurnal and nocturnal Heat by *Fahrenheit's* Thermometer were taken by the same Method.

The Deductions from the Table, p. 323. *infra*, I have digested all that I could of them tabularly, that they might be as clear and short as possible, and appear to me to point out the physical Principles, from whence we may account for the Production of these epidemic Diseases of the different Seasons, which are not infectious. For are not these the Effects of different Constitutions of the Air on human Bodies? And are not the Increments and Decrements of the sensible and insensible Excretions, Regard at the same time being had to the Quantity and Quality of the *Ingesta*, and to the Exercise, &c. the only *Index* of the Changes produced in the human Constitution, by the Vicissitudes of the Weather?

That indeed was the only View I had in going thro' these troublesome Experiments with so great Assiduity for one whole Year. The Design was benevolent, and I am afraid far superior to my Capacity, especially as I am situated in a Place where I can have no immediate Assistance.

That I may be furnished with as many *Data* as possible, I propose to take the specific Gravity of the *Cruor*, of the *Serum* and *Crassamentum* of the Blood, in different Diseases, and in their several *Stadia*, by a very nice hydrostatic Balance, made by Mr. *Jackson*. But this indeed is attended with greater Difficulties than I was at first apprised of; for the Experiment requires a greater Quantity of Blood

than can at all times be safely taken away; and Rain-Water, with which the specific Gravity of the Blood is compared, I have found, by repeated Experiments, to lose about  $\frac{3}{51\frac{1}{2}}$  Parts of a Grain for each Degree of Heat by *Fahrenheit's* Thermometer; and Oil of Turpentine, in which the *Crassamentum* is weigh'd, loses much more of its specific Gravity.

If I can possibly obtain the same kind of Instruments which *Dr. Langrish* used, I would likewise take the Cohesion of the Blood, and analyse it and the Urine in different Diseases, &c. but the Difficulty of getting exact Instruments is very great.

That you may enjoy long Life, and perfect Health, to improve that Science in which you are so worthily exercised, is the sincere Wish of,

S I R,

*Your most obliged,*

*and most humble Servant,*

John Lining.

AS the Quantity of *Ingesta* varied considerably in almost every Month, the Increase and Decrease of the several *Excreta*, as they were influenced by that Constitution of the Air, which is exhibited in TAB. IV. p. 506, 507. *Transf.* N°. 470. cannot plainly appear. I have therefore calculated the following Table from that, supposing the mean *Ingesta* of each Month to be 3000 Ounces, which is equal to 100 Ounces each Day; and that the several *Excreta* were evacuated in the same

*Ratio*

*Ratio* from these 3000 Ounces, as from the real Quantity of each Month's *Ingesta*: Whence the Increment or Decrement of the sensible and insensible Evacuations, in each Month, as they were influenced by the Weather, will be more conspicuous.

	Urine	Perfp.	Stools	Urine		Perspirat.		Stools	
				Increased.	Diminished.	Increased.	Diminished.	Increased.	Diminished.
March	1799	1106	91						
April	1618	1323	91		181	217			
May	1731	1492	87		187	169			4
June	1254	1706	91		177	214		4	
July	977	1941	88		277	235			3
Aug.	1274	1628	98	297			313	10	
Sept.	1016	1943	113		258	315		15	
Octob.	1477	1263	191	461			680	78	
Nov.	1717	1107	91	240			156		100
Dec.	1790	1078	95	73			29	4	
Jan.	1846	1006	104	56			72	9	
Feb.	1976	948	81	130			58		23

THE following TABLE contains the Sum of the *Excreta* in the different Seasons.

[*To be added to* TAB. VI. *Transf.* N<sup>o</sup>. 470. p. 508.]

	Urine.	Perspirat.	Stools.
Spring.	5393	3377	263
Summer.	3662	5139	266
Autumn.	3767	4834	402
Winter.	5353	3191	290

THE succeeding TABLE contains in Ounces and Centesimals the mean diurnal and nocturnal Urine and Perspiration of one Hour in each Month, with their *Ratio's* to each other: and that the Causes of the great Disproportion which they bear to each other, in the different Seasons, may be more conspicuous, I have added the mean thermometrical Altitude in the Heat of the Day, and at Bed-time, in each Month of the Year.

Mean

	Mean Per- piration of one Hour.		Mean Urine of one Hour		The Ratio's which the diurnal and nocturnal Perspiration and Urine bear to each other.				Mean thermo- metrical Alti- tude.			The mean daily <i>Ingesta</i> .
	Nocturnal.	Diurnal.	Diurnal.	Nocturnal.	The diurnal Perspiration is to the nocturnal as 1 to	The diurnal Urine is to the nocturnal as 1 to	The diurnal Perspiration is to the diurnal Urine as 1 to	The noct. Perspirat. to the noct. Urine as 1 to	At 3 in the Afternoon.	At Bed-time.	The Difference.	
March	1.85	1.71	3.16	2.61	0.924	0.826	1.71	1.52	63	54	9	117.38
April	2.45	1.72	2.69	2.06	0.702	0.766	1.10	1.19	74	65	9	109.03
May	2.75	1.77	2.22	2.58	0.644	1.164	0.81	1.46	78	70	8	117.92
June	3.42	2.1	2.	2.55	0.611	1.117	0.58	1.21	83	74	9	125.51
July	4.42	2.08	1.57	2.37	0.471	1.510	0.35	1.14	86	76	10	138.78
August	3.6	1.66	2.05	2.87	0.461	1.400	0.57	1.73	81	74	7	130.42
September	3.63	1.77	1.69	2.13	0.488	1.260	0.46	1.20	78	72	6	118.22
October	1.74	1.68	1.71	2.35	0.966	1.374	0.98	1.40	63	56	7	96.89
November	1.78	1.57	2.79	2.32	0.882	0.832	1.57	1.48	56	50	6	109.62
December	1.98	1.42	3.18	2.43	0.717	0.764	1.61	1.70	48	41	7	118.43
January	1.88	1.37	3.64	1.7	0.728	0.407	1.94	1.24	50	43	7	118.76
February	1.74	1.36	3.89	2.22	0.782	0.571	2.24	1.63	52	46	6	118.46
The Means	2.61	1.68	2.55	2.35	0.644	0.922	0.98	1.40	68	60	8	117.88

From the preceding TABLE it appears, that,

1. The mean diurnal Perpiration in the  $\left. \begin{array}{l} \text{Spring} \\ \text{Summer} \\ \text{Autumn} \\ \text{Winter} \\ \text{Year} \end{array} \right\}$  was  $\left. \begin{array}{l} .20 \\ .44 \\ 43 \\ .23 \\ 36 \end{array} \right\}$  Parts greater than the mean nocturnal Perpiration in the  $\left. \begin{array}{l} \text{Spring} \\ \text{Summer} \\ \text{Autumn} \\ \text{Winter} \\ \text{Year} \end{array} \right\}$  And the Days warmer than the Nights by  $\left. \begin{array}{l} 8 \\ 9 \\ 7 \\ 6 \\ 9 \end{array} \right\}$  Degrees.

2. The mean diurnal Urine in the  $\left. \begin{array}{l} \text{Spring} \\ \text{Summer} \\ \text{Autumn} \\ \text{Winter} \\ \text{Year} \end{array} \right\}$  was  $\left. \begin{array}{l} .29 \\ .23 \\ .32 \\ .33 \\ .08 \end{array} \right\}$  Parts greater than the mean nocturnal Urine in  $\left. \begin{array}{l} \text{Spring} \\ \text{Summer} \\ \text{Autumn} \\ \text{Winter} \\ \text{Year} \end{array} \right\}$  the  $\left. \begin{array}{l} \text{Spring} \\ \text{Summer} \\ \text{Autumn} \\ \text{Winter} \\ \text{Year} \end{array} \right\}$

3. The Excess of the mean diurnal Perpiration above the nocturnal in  $\left. \begin{array}{l} \text{Spring} \\ \text{Summer} \\ \text{Autumn} \end{array} \right\}$  was  $\left. \begin{array}{l} .04 \\ .72 \\ .67 \end{array} \right\}$  Parts, than was the Excess of the mean diurnal Perpiration above the nocturnal in Winter.

4. The Excess of the mean diurnal Perspiration above the nocturnal, in *July*, *August*, and *September*, taken together, which are our sickly Months, exceeded the Excess of the mean diurnal Perspiration above the nocturnal in Winter, by .79 Parts of what was the mean diurnal Perspiration above the nocturnal in these 3 hot Months taken together.

5. Though the mean nocturnal Heat in *July*, *August*, and *September*, taken together, exceeded the mean diurnal Heat in *November*, *December*, *January*, and *February*, taken together, by 22 Degrees; yet the Perspiration, under such very different Degrees of Heat, was nearly equal. For the mean nocturnal Perspiration of one Hour, in these 3 warm Months taken together, was 884 Grains; and the mean diurnal Perspiration of one Hour, in these 4 cold Months taken together, was 889 Grains.

6. In *July*, tho' the Excess of the mean diurnal Heat above the nocturnal exceeded the Excess of the mean diurnal Heat above the nocturnal in Winter by 4 Degrees only; yet the Excess of the mean diurnal Perspiration above the nocturnal in *July* exceeded the Excess of the mean diurnal Perspiration above the nocturnal in Winter, by  $\frac{82}{100}$  Parts of what was the Excess of the mean diurnal Perspiration above the nocturnal in *July*.

7. The Day and Night's Perspiration, at a *Medium*, in equal Spaces of Time, was more nearly equal in the cold than in the hot Months; and in *October* and *November*, or at the Accession of the cold Weather, they were more equal than in any Month of the Year, *March* excepted.

8. The Evenings and Nights are not absolutely colder in proportion to the Heat of the Day in Au-



tain, than in any other Season of the Year, as *Celsus* has affirmed; but are only so relatively, as, at that Season, we are weakest, and most sensibly affected by any Increment or Decrement of the Air's Heat.

9. In *June, July, August, and September*, taken together, the Excess of the mean nocturnal Urine above the diurnal, in equal Times, was .65 Parts deficient of what was the Decrement of the nocturnal Perspiration, or the Excess of the diurnal Perspiration above the nocturnal in these 4 warm Months taken together.

10. In Summer, the Excess of the mean nocturnal Urine above the diurnal was .63 Parts less than was the Decrement of the nocturnal Perspiration in that Season.

11. In Autumn, the Excess of the mean nocturnal Urine above the diurnal was .34 Parts less than what was the Decrement of the nocturnal Perspiration in that Season.

12. The Excess of the mean nocturnal Urine above the diurnal was not equal to the Decrement of the nocturnal Perspiration in *May, June, July, August, September*, by .61, .58, .66, .58, .63 Parts of what was respectively the Decrement of the nocturnal Perspiration in these Months; but, in *October*, the Excess of the nocturnal Urine above the diurnal was .91 Parts greater than was the Decrement of the nocturnal Perspiration in that Month.

13. If the mean diurnal *Ingesta* had been 100 Ounces thro' the Year, and the Excretions proportionate from that Quantity to what they were from the real mean diurnal *Ingesta* of each Month, then, by Computation, it appears, that

*April*

A. The mean diurnal Perpiration in	April	was increased	.30	Parts of what was the mean diurnal Perspir. in	and was increased	.33
	May		.04			.42
	June	.14	and was diminish'd		.52	
	July	.18			.43	
	August	.16	and was diminish'd		.49	
	Sept.	.10			.23	
	Octob.	.42	and was diminish'd		.47	
	Nov.	.10			.52	
	Dec.	.10	and was diminish'd		.48	
	Jan.	.07			.52	
Febr.	.07					

B. The mean nocturnal Perpiration in	April	was increased	.08	Parts of what was the mean nocturnal Perpiration in	and was increased	.03
	May		.05			.13
	June	.10	and was diminish'd		.06	
	July	.07			.12	
	August	.18	and was increased		.03	
	Sept.	.15			.16	
	Octob.	.13	and was diminish'd		.01	
	Nov.	.17			.23	
	Dec.	.22	and was diminish'd		.21	
	Jan.	.03			.21	
Febr.						

April

C, The mean diurnal Urine in	April May June July August Sept. Octob. Nov. Dec. Jan. Febr.	was diminished. was increased was diminished. was increased	.08 .32 .05 .16 .25 .09 .19 .31 .06 .12 .07	Parts of what was the mean diurnal Urine in	and was diminished & was equal to the diurnal Urine of March. and was increased	March April May June July August Sept. Octob. Nov. Dec. Jan.	.38 .41 .57 .47 .35 .06 .12 .18	Parts of what was the mean diurnal Urine in March.

D, The mean nocturnal Urine in	April May June July August Sept. Octob. Nov. Dec. Jan. Feb.	was diminished. was increased was diminished. was increased was diminished.	.15 .14 .07 .13 .20 .19 .26 .13 .03 .12 .17	Parts of what was the mean nocturnal Urine in	and was diminished and was increased and was diminished	March April May June July August Sept. Octob. Nov. Dec. Jan.	.01 .09 .20 .01 .19 .09 .08 .47 .16	Parts of what was the mean nocturnal Urine in March.

The following TABLE exhibits, in Ounces and Centesimals, the greatest and least mean diurnal Urine and Perspiration of one Hour.

[This to be added to TAB. II. *Transf.* N°. 470. p. 503.]

	Mean diurnal Urine of one Hour		Mean diurnal Perspiration of one Hour	
	greatest	least	greatest	least
March	5.01	1.81	3.64	1.07
April	4.41	1.47	3.37	1.42
May	3.9	0.83	4.42	1.32
June	3.89	1.15	5.25	1.7
July	3.88	0.71	5.64	2.36
August	3.52	0.95	5.56	1.85
September	3.95	0.62	5.12	2.22
October	3.46	0.67	2.66	0.93
November	4.83	1.14	2.11	1.36
December	5.13	1.60	3.04	1.34
January	6.39	1.40	2.61	1.45
February	6.29	2.05	2.26	0.79

A TABLE of the Depth of Rain in Inches and millifimal Parts in *Charles-Town*.

	1738	1739	1740	1741	1742	1743	The Means
January	1. 097	2. 310	4. 873	4. 492	2. 189	3. 172	3. 022
February	4. 416	2. 875	3. 084	3. 535	1. 650	2. 435	2. 999
March	4. 532	5. 609	1. 141	5. 713	5. 203	0. 621	3. 803
April	1. 082	0. 195	1. 092	1. 308	0. 918	5. 292	1. 648
May	3. 127	5. 120	5. 612	4. 841	5. 898	2. 535	4. 522
June	1. 567	15. 839	4. 648	5. 538	3. 250	1. 903	5. 458
July	10. 660	5. 452	3. 013	3. 399	1. 252	7. 738	5. 252
August	4. 104	12. 211	7. 301	7. 144	7. 647	3. 767	7. 029
September	10. 792	4. 834	3. 200	6. 734	2. 895	4. 686	5. 524
October	1. 358	6. 593	1. 257	3. 399	0. 759	1. 672	2. 506
November	2. 656	1. 235	1. 848	2. 964	3. 388	3. 220	2. 552
December	3. 877	3. 689	2. 736	1. 919	0. 957	2. 706	2. 647
Total Depth	49. 268	65. 962	39. 805	50. 986	35. 826	39. 747	46. 932