in and ceases soon, and putrefaction appears and progresses quickly. The two distinct series of facts I have adduced seem, therefore, to bear out clearly the truth of the law I have endeavoured to establish on the relation between the degree of muscular irritability and the period of setting in and the duration of cadaveric rigidity, and also the time of appearance and the progress of putrefaction.

The Society then adjourned to Thursday, May 30th.

May 30, 1861.

Sir HENRY HOLLAND, Bart., V.P., in the Chair.

The reading of Dr. EDWARD SMITH's Paper "On the Elimination of Urea and Urinary Water, in their relation to the Period of the Day, Season, Exertion, Food, and other influences acting on the Cycle of the Year," was resumed and concluded.

(Abstract.)

This communication contains the result of two principal series of inquiries which have been prosecuted by the author, viz. one upon himself, extending from January 1860 to March 1861, and comprehending 336 days; and the other upon four prisoners during the month of March 1860.

The former series included the amounts of urea, chloride of sodium, and urinary water evolved daily throughout the seasons, and their relation to period of the day, season, temperature, barometric pressure, and also to the cycle of the week, excess of food, and stomach derangement. The author also ascertained the effect of fasting from solid food and of drinking water, tea, coffee, and alcohol, in the absence of breakfast and during a whole day's fast. The net weight of the body night and morning was ascertained for many weeks in the early part of 1861, and the amount of fluid and solid food was recorded during many months of the year. During these inquiries the author lived in a moderate and regular manner, but without any prescribed dietary, and spent a part of August and

September at the sea side. He is æt. 42, weighs 196 lbs., and is in perfect health. The experiments upon prisoners were made in Coldbath-fields Prison, upon four prisoners in an average state of health, but below the average weight. The object was to determine the effect of treadwheel labour. The prisoners worked the wheel three days, and pursued routine labour on other three days in each week, whilst they rested on the Sunday. Their diet was good, and consisted of 20 oz. of bread, 6 oz. of cooked meat, 8 oz. of potatoes, 1 pint of cocoa, and 1 pint of gruel daily, besides a regulated quantity of water, which they drank at prescribed periods. They were under the immediate charge of an officer, and the greatest care was taken to ensure accurate results. On treadwheel days the urine was collected whilst the labour was performed and before breakfast was taken, and at other periods of the day, in a defined manner. The fæces were weighed, and samples of the fæces, urine and food, were kindly analysed by Mr. Manning. During the inquiry certain alterations of diet were made for periods of three days each, such as the administration of extra fat, tea, coffee, and alcohol, and the withdrawal of the chloride of sodium.

The analyses for urea and chloride of sodium were made by the author, and Liebig's method was adopted.

Both series comprised more than 1200 analyses for urea and 2000 collections of urine.

The following are the principal results obtained:—

1. The daily excretion of urea varied from 298 grs. to 748·5 grs., but on the average of the year was 519 grs., or 2·73 grs. to each lb. of body weight.

2. The extreme amounts of urine were 24·5 fl. oz. and 92·6 fl. oz., with a total average of 53·1 fl. oz. daily. The relation to body weight was ·28 fl. oz. to each lb. There were noticeable daily alterations in the quantity, or the amounts proceeded in waves or arches, or progressively increased or decreased in a striking manner through a series of days under the influence of meteorological conditions and the statics of the body. The amounts derived from the cycle of the year are almost identical with the average of all recorded inquiries made for short periods, and upon various persons, and show the extreme value of including the cycle of the year.

3. The average quantity of urea in each oz. of urine was 9·4 grs.

This quantity increased with increase of urinary water above, and decreased with decrease of that fluid below the average; but the former in much higher proportion than the latter.

4. The average hourly emission of urea was on the whole day 21·7 grs.; during the night 16·5 grs.; before breakfast 20·3 grs.; and before midday 25·5 grs. The decrease of the night was 24, and of the early morning, or "basis quantity," 6·4 per cent., whilst the increase to mid-day was 17½ per cent. The "basis quantity" was so much influenced by the amount of urine passed on the previous day, that it was not a good standard of comparison for its own day.

The greatest increase of urea followed the breakfast, and the next followed the tea meal; whilst there was a considerable decrease at and after the hour of the early dinner. When an examination was made every ¼ of an hour, a maximum increase of 54·6 grs. of urea and 21 oz. of urine per hour was found.

5. There was the same general relationship of urinary water to the period of the day, but there was scarcely any increased evolution of that fluid in the afternoon.

6. Water taken several times during a day of fasting caused the same hourly progression in the elimination of urea and urine as occurs with food, except that the changes were more rapid and the decrease at the end of the intervals was greater. The maximum was 34·5 grs. of urea, and 11·5 oz. of urine.

7. When water was taken thrice before midday, and without breakfast, there was a large and rapid elimination of urea and urinary water; but when bread, tea, coffee, and black draught were added, the elimination was retarded. Alcohol with water, taken once before breakfast, caused within two hours an increase of 38 to 108 per cent. of urea, and 246 to 554 per cent. of urine.

8. With a daily dietary of bread and water, the hourly elimination was the same as with ordinary food; but when tea and coffee were added, there was a less morning and a greater evening increase of urea; but the amount of urine was altogether lessened.

9. There was the largest elimination of urea, carbonic acid, and fæces on the Sunday; and on that day there was much more rest, an increase of solid food, and a daily gain in weight of from 1 lb. 6 oz. to 2 lb. 3 oz.

10. The weight of the body was greatest on the Sunday, and lessened through a week of regular bodily exertion, but varied as the food and exertion varied. There were variations of several pounds recorded in each week.

11. The average weight of the solid ingesta during four months was 37 oz. in the week-day, and 41¾ oz. on the Sunday; whilst the average weight of both fluid and solid ingesta was from 89¼ oz. to 95 oz., and 95¾ oz. at the same period.

12. The largest average elimination of urea and urinary water occurred from May to October (viz. 570 grs. and 480 grs. of urea), and the excess of the maximum over the minimum was 46·1 and 40·2 per cent.

13. The effect of temperature and atmospheric pressure was direct, and increased the elimination of urea and urinary water; but the former increase was commonly found on the succeeding day. When the two acted in the same direction, the common effect was increased; but when they were opposed they disturbed the result. Sudden increase of temperatnre lessened, and sudden cold increased the elimination of urea.

14. Treadwheel labour caused an increased elimination of 19 grs. of urea over that of days of routine labour, and 34 grains over that of the Sundays; but, in addition, the rate of elimination of urea to body weight was very high; viz. 4·39 to 4·74 grs. per lb.

The labour of the treadwheel was equal to lifting 354 to 413 tons through 1 foot per day, or to walking about 29 miles daily. Sometimes the effect upon the urea was deferred until the following day.

15. Unusual and additional food always increase the elimination of urea; and, with headache and stomach derangement, there was commonly a temporary diminution in the excretion.

16. Tea, coffee, and alcohol, given to the prisoners, temporarily lessened the excretion of urea and urinary water, tea having the greatest effect upon the urea, and alcohol upon the urinary water; but this effect lessened after the first or second day. Tea increased the evolution of chloride of sodium, and alcohol decreased it proportionally with the urine.

17. When ¾ oz. of chloride of sodium was withheld from the food, the same quantity was absent in the urine.

18. The amount of fæces was very large in the prisoners (8·55 oz.

average), and contained 41·8 grs. of nitrogen daily. It was largest on the Sunday, and the fæces then contained an increase of nitrogen equal to the quantity lost by the urine on that day. Hence the assimilation was defective, but it was increased by labour.

The author then showed the relations of urea and carbonic acid, and their dependence upon food, season, and period of the day, and discussed the relation of urea to exertion and nutrition, showing that unless there be continued waste of the nitrogenous tissue, there cannot be any important increase of urea from exertion.

The paper was accompanied by numerous explanatory tables and curves.

The following communication was read :—

"On the Theory of the Polyedra." By the Rev. T. P. Kirkman, M.A., F.R.S., and Hon. Member of the Literary and Philosophical Society of Manchester. Received May 10, 1861.

(Abstract.)

The complete resolution of the problem of the polyedra embraces the construction of all P-edra Q-acra, with an account of the symmetry of the solids when symmetrical. Such construction being impracticable from the magnitude of the task, it is desirable that a method should be found of classifying and enumerating the P-edra Q-acra, so that from this knowledge of the inferior polyedra, the same can be obtained concerning the higher, without any constructions, and without any tentative process.

I have found that all attempts to enumerate a separate and well-defined family of the P-edra Q-acra, beyond that I have called 'The partitions of the R-pyramid' (Phil. Trans. 1858), have been fruitless, and that the simplest method of solving the problem is to solve it entirely.

It is necessary first to have an accurate classification of polyedra as to symmetry. This is—

1. Zoned symmetry;
2. Zoneless axial symmetry;
3. Mixed symmetry, both 1 and 2;
4. Neuter symmetry, neither 1 nor 2;
5. Asymmetrical.