Later.—The Finlay ephemeris needs corrections of $-24m$. R.A., -3° decl.

M. Ebell gives the following orbit of Kopff's comet 1919a, from observations 1919 July 31, August 20, September 16 (*Ast. Nach.*, 5016):—

$T = 1919 \text{ June } 28^{\text{h}} 21^{\text{m}} 0^{\text{s}}$ G.M.T.	$\phi = 30^\circ 56' 40''$
$\omega = 19^\circ 43' 51''$	$\mu = 538.904''$
$\Omega = 263^\circ 48' 51''$ 1919.0	$\log a = 0.545664$
$i = 8^\circ 41' 30''$	Period = 6.5841 years

The mean observed period between 1906 and 1919 is 6.5766 years.

UNVEILING OF LISTER MEMORIAL TABLETS.

BRIEF mention was made last week of the unveiling at University College, London, of two bas-relief tablets in memory of Lord Lister, one of the most distinguished *alumni* of the college. There were present the Duke of Bedford (president of the Lister Memorial Committee), the president of the Royal Society, the president of the Royal College of Surgeons, Sir William Lister, the Misses Lister, and Miss Godlee (relatives of the late Lord Lister), the

Lister Memorial Tablet at University College, London. A similar tablet has been secured for University College Hospital, where Lister was student and house surgeon in 1843-52.

Vice-Chancellor of the University, the Provost of University College and Lady Foster, Sir John Bradford, Sir George Thane, Sir Thomas Barlow, Sir John Tweedy, Sir Ernest Hatch, and many others. The proceedings were opened by the Duke of Bedford, who referred to Lister's connection with University College, and commented upon the great value of Lister's presence in the House of Lords. Before unveiling the tablet destined to be erected at University College Hospital, where Lister was once house surgeon, Sir George Makins outlined the main events of Lister's life, the success of which was due to his thorough training as a student. Sir

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Joseph Thomson unveiled the tablet for University College. He said that Lister, one of the glories of British science, began his connection with the Royal Society at the early age of thirty-three, when he was elected a fellow. During Lister's five years' tenure of the presidency of the society much excellent administrative work was carried out, and this epoch saw the inception of several famous biological investigations organised by the society. The Provost (Sir Gregory Foster) then invited Sir Edwin Cooper Perry (the Vice-Chancellor), Sir George Thane, Sir Ernest Hatch, and Mr. Raymond Johnson to accept the tablets on behalf of the bodies they represented. Sir George Thane, in reply, mentioned that University College had that day been presented with one of Lister's prizes received whilst a student, and he expressed the hope that owners of Lister mementoes might present them to the college. On behalf of the memorial committee Sir John Tweedy conveyed the thanks of the subscribers to the sculptor, Prof. Havard Thomas.

THE BRITISH ASSOCIATION AT BOURNEMOUTH.

SECTION I.

PHYSIOLOGY.

OPENING ADDRESS (ABSTRACTED) BY PROF. D. NOËL PATON, M.D., F.R.S., PRESIDENT OF THE SECTION.

IN the advance of every science certain difficulties and dangers which must be encountered tend to make the progress of knowledge somewhat devious, somewhat zigzag in character.

(1) The study of the metabolism of proteins in the animal body, especially when they are considered as a source of energy, illustrates this in a striking manner. Liebig's teaching insisted on their prime importance. The investigations of Voit and of Fick and Wislicenus—unsatisfactory as the latter were—caused a swing to the other extreme, to the view that carbohydrates, not proteins, are the main source of energy. The work of Pflüger and of his school brought about a temporary swing back to Liebig's teaching. Only when it became possible to study the respiratory exchanges along with the excretion of nitrogen was a true knowledge gained of the relative importance of proteins and of the other two proximate principles.

(2) As regards the use of proteins in the building and repair of the tissues, progress has been more direct, and has ultimately led to the recognition of the importance of the constituent amino-acids as the "building stones" of the proteins. In this connection the importance of the diamino-acids lysin, histidin, and arginin must be recognised. Their presence has been shown to be necessary for growth. The presence of guanidin in the arginin molecule requires more attention than it has yet received.

(3) An aspect of protein metabolism which has been more recently elucidated is the physiological activity of the constituent amino-acids in explaining the stimulating action—the specific dynamic action—of proteins upon the general metabolism and upon heat production.

The evidence of whether guanidin may be a product manifesting a physiological action in the body is worthy of study. The investigations of Kossel and Dakin and the earlier work of Thompson do not negative the probability of the liberation of guanidin from arginin in muscle, while the more recent work of Inouye and of Thompson indicate that guanidin may be split off from arginin. The formation of guanidin, either free or combined, from non-protein sources was demonstrated by Burns to occur in the hen's egg during

the first twelve days of incubation up to the time of the appearance of creatin. That the cholin of the lecithin of the yolk is the precursor is rendered probable by the evidence adduced by Reisser and by Baumann Hines and Marker that creatin is formed from cholin.

That free methyl-guanidin is a normal constituent of muscle has been shown by the work of various investigators, and these results have been confirmed recently by Henderson. It is a normal constituent of the urine, even of such animals as the horse, which lives upon a creatin-free diet.

Guanidin and methyl-guanidin have marked physiological actions. They stimulate the efferent neurons of the spinal cord, causing tremors, jerkings, and extensor tonus. In large doses applied to the spinal cord, they paralyse. On the nerve-endings in muscle they have first a stimulating effect, so that the electrical excitability is increased, but later and in large doses they have a curare-like action. The symptoms are similar to those following ablation of the parathyroids and to those of idiopathic tetany in children. In the blood and in the urine of parathyroid ectomised dogs and in the urine of children with tetany, Burns and Sharpe demonstrated an enormous increase in the amount of guanidin present, an increase to which Koch had previously directed attention.

The conclusion seems to be that, under normal conditions, free methyl-guanidin maintains a tonic action on the efferent neurons and so on the muscles, and that the amount of guanidin is controlled by the parathyroids.

The few observations so far made point to the excretion unchanged of only a part of injected guanidin. A possible explanation of this seems to be that part is linked with acetic acid and so converted to creatin and then rendered inert.

Previous work on the formation of creatin from glycocyamin, guanidin acetic acid, renders this probable. Recently in my laboratory Wishart has found a distinct increase in the creatin content of the muscles after the injection of guanidin sulphate, thus proving the conversion.

The nature of the combination of creatin in muscle is not yet known. Folin maintains that creatin is an integral part of the muscle substance, and that it is liberated as muscle dies and disintegrates. Evidence of this is lacking, and some recent experiments by Wishart show that in muscle frozen during life and extracted near the freezing-point the creatin content is the same as in muscle treated in the usual way. Folin's own work on the concentration of creatin in muscle does not seem to support his theory.

In the light of these results and of this view of the mode of formation of creatin from guanidin, what is the significance of the creatin which appears in the urine? This problem may best be investigated in animals in which the question of the relationship of creatin to creatinin need not be considered. Meissner in 1868 maintained that this is the case in birds, and his conclusion I verified in 1910. It has since been further substantiated by the work of Thompson. In birds during fasting the excretion of creatin is increased, just as in mammals the excretion of the combined creatin and creatinin is generally increased. Myers and Fine claim that the creatin excreted is derived from the creatin present in muscle at the beginning of the fast, while Stanley Benedict and Osterberg maintain that there is a constant fresh formation of creatin. The experimental basis of the latter conclusion seems to be unsubstantial, since they administered protein containing arginin and therefore guanidin, from which the creatin might have been formed.

In 1910 I maintained that, from the amount of
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creatin excreted by the bird during a fast, the amount of muscle disintegrated might be calculated. Whether the liberated creatin is simply excreted, or whether its resynthesis into muscles is prevented, the amount in the urine indicates the breakdown and non-regeneration of muscle, *i.e.* the *actual* disintegration. Hence a study of the relationship of the creatin nitrogen to the total nitrogen excreted enables a conclusion to be drawn as to whether the loss is falling chiefly upon muscle or upon other organs of the body. A study of the metabolism of the bird in fasting shows that such conclusions may be drawn, and, accepting Folin's most recent view of the significance of urinary creatin and creatinin, the excretion of the nitrogen in these substances, taken along with the total excretion of nitrogen, affords a means of elucidating further the progress of protein metabolism in fasting.

The work of Cathcart and others seems to show that creatin, in the presence of carbohydrates, may be resynthesised into the muscle substance. This in no way invalidates the view that it is formed to detoxicate guanidin. Lecithin, which is undoubtedly used in the construction of the tissues, plays a like part in detoxicating cholin.

As regards the relationship of creatin to creatinin, in spite of the very considerable literature which has appeared upon the subject, our knowledge has advanced little since the time of Meissner. The mass of evidence seems to favour the view that the creatinin daily excreted is derived from the creatin of muscle, but that the power of conversion is very limited, and that it varies in different individuals and in different species of animal.

The considerations here adduced seem to point to the conclusions:—(1) That creatin is formed from excess guanidin or methyl-guanidin in order to limit the toxic action of these; (2) that it is to a limited extent stored in muscle, any excess being excreted in the urine, either unchanged as in the bird, or in the form of creatinin in the mammal; (3) that during fasting and in the absence of carbohydrates it is liberated as the muscle disintegrates; and (4) that it may be recombined into the muscle molecule if the supply of carbohydrates is adequate.

RADIOTELEGRAPHY DURING THE SOLAR ECLIPSE OF MAY 29.¹

IN connection with the solar eclipse of May 29 the committee arranged for the carrying out of experiments on the effect of the eclipse on signals transmitted across the central line. The British Admiralty stations at Ascension and the Azores transmitted continuously during the transit of the umbra across the Atlantic Ocean. Observing stations north of the equator were for the most part asked to listen to Ascension for at least an hour round about the time when the umbra passed between themselves and Ascension; observers south of the equator were asked for the most part to listen to the Azores. Certain selected stations north of the equator were also asked to listen to the Azores, so as to afford check observations upon the variations which might be observed in signals passing across the central line of the eclipse, and, similarly, selected stations south of the central line were asked to listen to Ascension. The American station at Sayville also transmitted a programme during a portion of the period of the eclipse, and arrangements were made for special experiments between Darien and the Falklands, and between an Egyptian station and a South African station.

¹ Report of a Committee of the British Association presented to Section A at the Bournemouth meeting, September 1919.