prediction of the orbital period over a range of the order of months on one hand and by the day-to-day variation in the rate of increase of the periodic time on the other. This second problem obviously requires a consideration of effects which are ignored in the customary analysis, of which the tidal influences of the Moon may well be one. However, the variations of this second type appear to be grouped about a mean behaviour consistent with the simple analysis. Thus Fig. 1 shows a comparison between the observed orbital period and that calculated on the relation given by me[1] over the period December 1–April 10. Here only first-order terms in e_0 are retained, but a correction for oblateness is included. The value of t_n was taken as 134·4 days and the scale-height was estimated at 33·5 nautical miles. The fit is decidedly better than that of King-Hele and Leslie, the only noticeable departure of the calculated values occurring in January when observations indicated a change in the effective drag cross-section. It should be noted that this agreement has not been obtained by an arbitrary assignment of parameters, since t_n is critically determined by the time of final fall and the only assignable parameter is the scale-height H. Undoubtedly the assumption of constant scale-height is violated in practice; but unless the agreement is purely fortuitous, it would appear that it varies little between 112 nautical miles and 95 nautical miles above the surface of the Earth. There is, however, some indication in the orbital data of a slight decrease in the value at lower levels.

It would seem that for prediction 'in the large' an analysis correct to the first order in e_0 but including a correction for the oblateness of the Earth is entirely adequate. This is further borne out by the fact that the failure of the asymptotic expansions of the Bessel functions at small values of the eccentricity is illusory, since the instability of the 'circular' form implies a non-zero minimum value of e. The second problem, that of accounting for the variations in the very sensitive rate of increase of periodic time, quite obviously requires considerably wider physical assumptions and is consequently beyond the scope of the present analysis.

D. G. PARKYN

Department of Mathematics,
University of Natal,
Pietermaritzburg.

[1] Parkyn, D. G., *Nature*, **181**, 1156 (1958).
[2] King-Hele, D. G., and Leslie, D. C. M., *Nature*, **181**, 1761 (1958).

IN the theoretical formula for the variation of the period of revolution with time, there are three roughly equal small terms, with coefficients e^2, H/a_0 and ε (the Earth's ellipticity). Mr. Parkyn obtains a good fit by ignoring the first two of these and retaining the third. It is not altogether satisfactory, however, when two terms which should apparently be included have to be omitted. Rather it suggests that some of the assumptions in the theory need to be improved; that was why we were reluctant to assign a value of H in our article, and we should be even more reluctant to guess its variation with height.

D. G. KING-HELE
D. C. M. LESLIE

Royal Aircraft Establishment,
Farnborough, Hants.

The Fundamental Molecular Event in Muscular Contraction

ASTBURY[1,2] suggested that the fundamental event in the contraction of muscle might involve a characteristic of the keratin–myosin–epidermin–fibrinogen group of fibrous proteins to which myosin belongs, namely, the folding or collapsing of polypeptide chains from the α-configuration into the supercontracted state. While it has been shown that isolated myosin and actomyosin supercontracts after reasonably mild chemical or physical treatment[2,3], no X-ray evidence has been forthcoming so far to show that the shrinkage of actomyosin gels after treatment with adenosine triphosphate is accompanied by a corresponding configurational change[4]. Moreover, there is the difficulty of reconciling this approach with recent concepts of a two-phase actin–myosin system shortening by close-range[5] or long-range[6] interaction of filaments coiling or sliding over one another in a regular stepwise fashion.

The demonstration by Astbury, Beighton and Weibull[7], in diffraction diagrams of bacterial flagella, of X-ray features characteristic of the supercontracted state (the 'cross-β' configuration[8]) side by side with an α-pattern having analogies with that of muscle suggests that the simplest molecular expression, of flagellar motility in any event, may be a rhythmic interchange between the α-state and a shorter supercontracted form. Recently, the discovery by Rudall[9] of a transversely folded protein in the egg-stalk of the lace-wing fly *Chrysopa* has much emphasized the possibility that there may commonly exist in Nature (as opposed to mechanical or chemical artefacts) a well-defined protein state in which the polypeptide chains lie in long regular folds[10].

We now report that the synæresis of actomyosin on addition of adenosine triphosphate is accompanied by X-ray indications of a transformation of a proportion of the protein into the supercontracted state.

The actomyosin used was extracted from the finely crushed dorsal muscle of fish by buffered alkaline potassium chloride and precipitated by lowering the ionic strength. After washing three times, with interspersed centrifugation, the actomyosin formed transparent thixotropic gels, still intensely reactive to adenosine triphosphate solutions[11] and capable of being dried on water-repellent glass blocks to form thin transparent films. The unsynæresed films could easily be stretched in moist air to give well-oriented α-diagrams characterized by the familiar meridional reflexion at about 5·1 A. After synæresis with adenosine triphosphate, the resultant opaque brittle films were difficult to handle, and the diffraction patterns of such unpromising material appeared to show only a vague sharpening on the meridian. By washing out the reactants immediately after addition of adenosine triphosphate, however, the partly contracted gels retained a certain capacity to stretch after drying, and such specimens could be sufficiently oriented to illustrate changes in the diffraction pattern.

Fig. 1 shows the diffraction pattern of a film prepared as just described of actomyosin from the dorsal muscle of the ruffe, *Acerina vulgaris*. The 'cross-β' configuration shows up as a faint preferred orientation at 4·65 A. on the meridian. The conditions for the appearance of an X-ray pattern indicating supercontraction in actomyosin appear to be very critical;