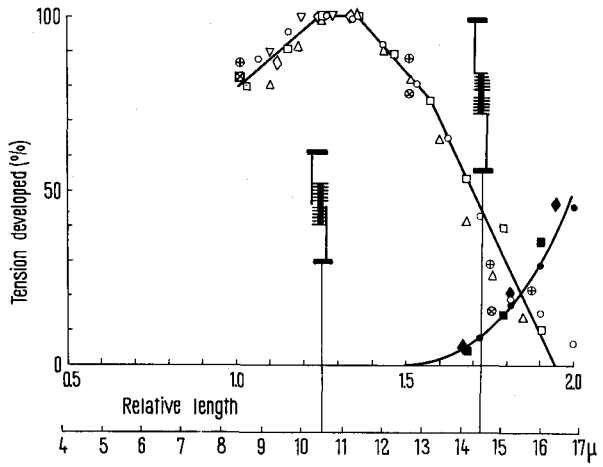
tension is close to that found on single twitch fibres of the frog[7] in tetani where the tendons were held similarly to the present case. A better fit could be expected if the influence of shortening of the fibre at the ends on the length-tension diagram was avoided[2,8].

A steeper fall in tension after stretching the fibre beyond its optimal length in the crayfish as compared with the frog can be ascribed to a lower A/I quotient in the crayfish than in the frog. The overlap between the thick and the thin filaments is then expected to cease at lower relative extension of the fibre in the crayfish than in the frog.



The length-tension diagram of 8 isolated muscle fibres of the crayfish (*Astacus fluviatilis*). Hollow symbols: maximal tension developed during a potassium contracture (174 m*M* K, 7.8 m*M* Cl), which was relaxed by reintroducing the crayfish saline (5.4 m*M* K, 250 m*M* Cl). Symbols with crosses refer to fibres relaxed spontaneously. Full symbols: the resting tension about 10 min after slowly stretching the fibre. Both the active and passive tension are given in relative units taking the amplitude of contracture at 1.25 l_0 as 100%. The lines through the experimental points were drawn by eye. Upper horizontal scale: the length of fibres in fractions of the slack length (= 1.0). Lower horizontal scale: the sarcomere length. The diagrams indicate the assumed degree of overlap between the thick and the thin filaments.

As the sarcomere length of crayfish muscle fibres is five times greater than that of twitch muscle fibres of the frog, one would expect from the sliding theory of contraction (the other factors controlling the tension[9] being constant) a five times higher tension in crayfish muscle fibres than in frog muscle fibres. The maximal tension at the optimal length is, however, only about twice (8.2 kg/cm^{-2}) as high in the crayfish as in the frog (about 4 kg/cm^{-2})[1,10]. The explanation follows from the comparison of the A/I quotients in these fibres. The A/I quotient in the crayfish (0.38) is half that found[2] in the frog (0.76). It can then be assumed that the number of those sites per cm^3 where the tension is generated, is in crayfish muscle fibres also half that present in frog fibres. A crayfish muscle fibre should then exert tension only 2.5 times greater than a frog fibre, which is in good agreement with the measured values of maximal tension in crayfish muscle fibres.

Zusammenfassung. An isolierten Muskelfasern von *Astacus fluviatilis* wurde mittels Kaliumkontraktur die Spannung-Sarkomerlängenrelation untersucht. Maximale Faserspannung wird bei einer Sarkomerlänge von 10,5 μ entwickelt. Werden Fasern zu einer Sarkomerlänge von 16,5 μ gedehnt, so ist die Spannung nicht mehr messbar. Diese Sarkomerlänge ist etwas grösser als diejenige (14.45 μ), die aus der Länge der dicken Filamente (3.95 μ) und der optimalen Länge hervorgeht.

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Occurrence and Morphology of a Fibrous Body in the Mitochondria of the Slime Mold *Physarum polycephalum*[1]

In a previous paper[2] we have reported that the mitochondria of the slime mold, *Physarum polycephalum*, when incubated with tritiated thymidine (10 μc/ml) incorporate this DNA precursor to such an extent that an intensive autoradiographic picture can be obtained by conventional procedures. In a search for a structural component of the mitochondria that might be related to this unusually high uptake of a DNA precursor, we found that the mitochondria contain a previously unknown fibrous body of considerable size. This body was present after different fixations, e.g. 2% osmic acid in growth medium[3] (pH 5), 1% osmic acid in collidine buffer (pH 7.8), and Palade's fixative. The latter was employed in obtaining the following electronmicrographs.

Surface plasmodia were prepared from microplasmodia as described previously[4]. Small explants from these plasmodia were fixed for 1 h in glutaraldehyde (2%, phosphate buffer, pH 7.4) and then placed, for 2 h, in Palade's fixative (1% osmic acid in veronal buffer, pH 7.4). The pieces were embedded in Epon according to LUFT[5]. Silver sections were prepared with a Porter-

[1] Supported by grants from USPHS (Grant No. GM 11949-03 and HD-0052-05).
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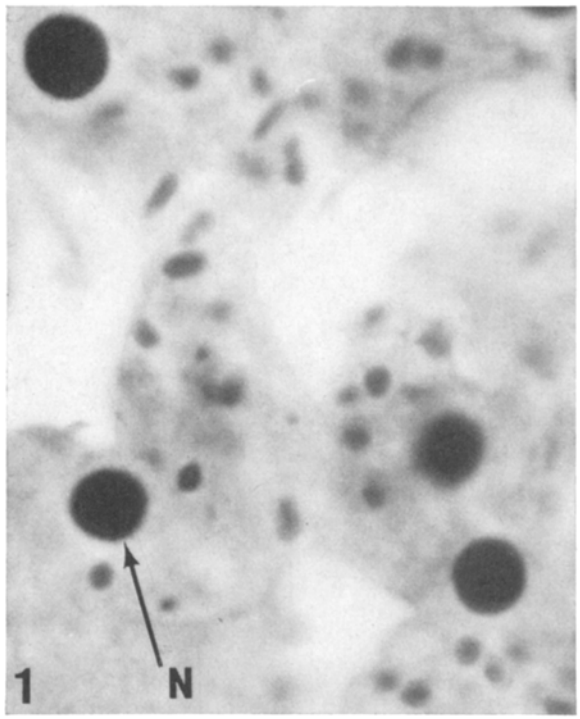

Fig. 1. Section (thickness: 3 μ) through plasmodium showing mitochondria of various shapes. N = nuclei. Magnification $\times$ 2500.

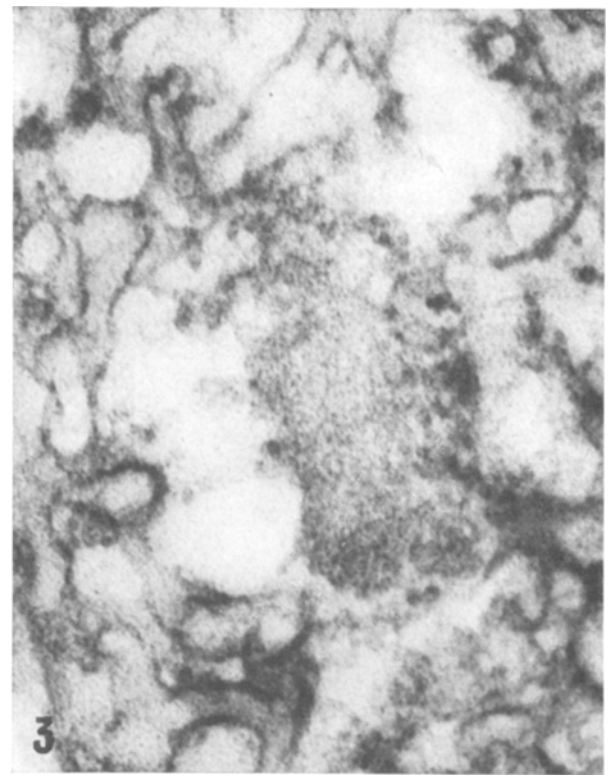

Fig. 3. Central body at higher magnification. (Photogr. Dr. RICHARD A. ELLIS). $\times$ 100,000.

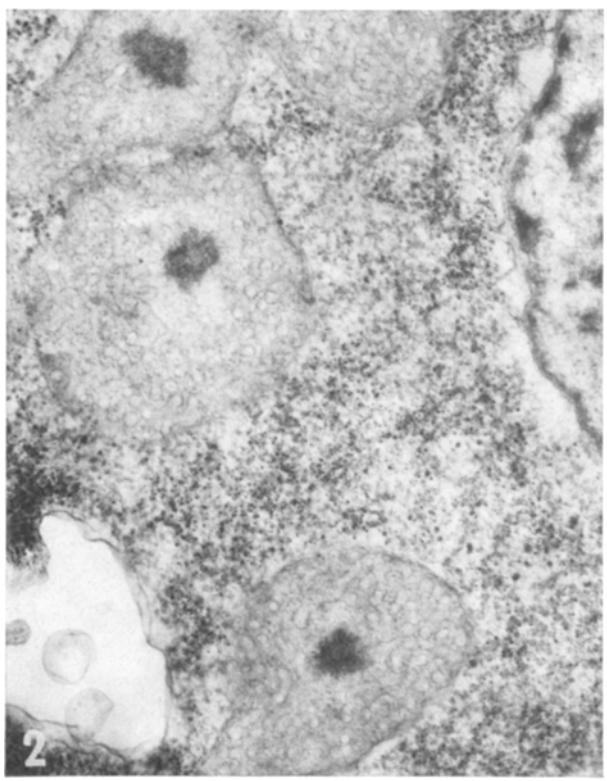

Fig. 2. Mitochondria with central bodies. $\times$ 28,400.

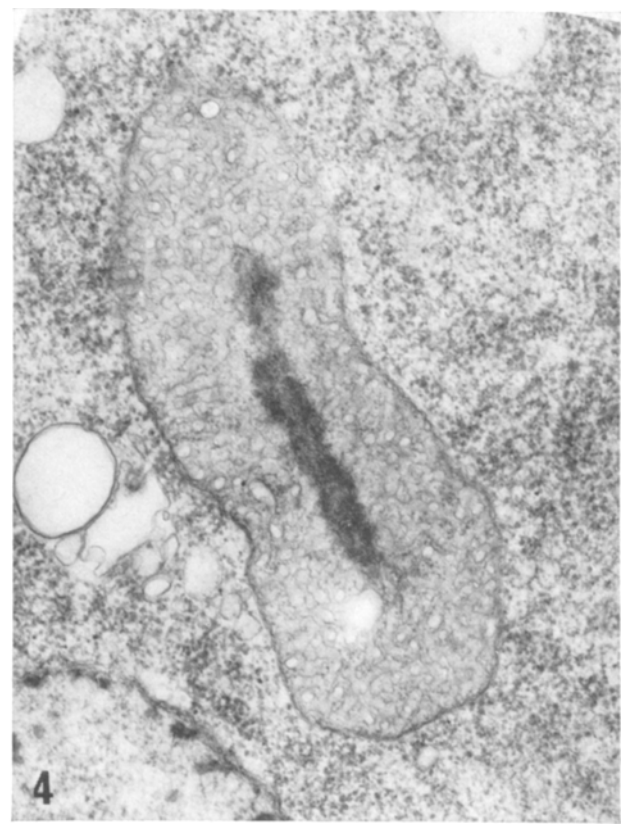

Fig. 4. Longitudinal section through rod-shaped mitochondrion Elongated central body. $\times$ 28,500.

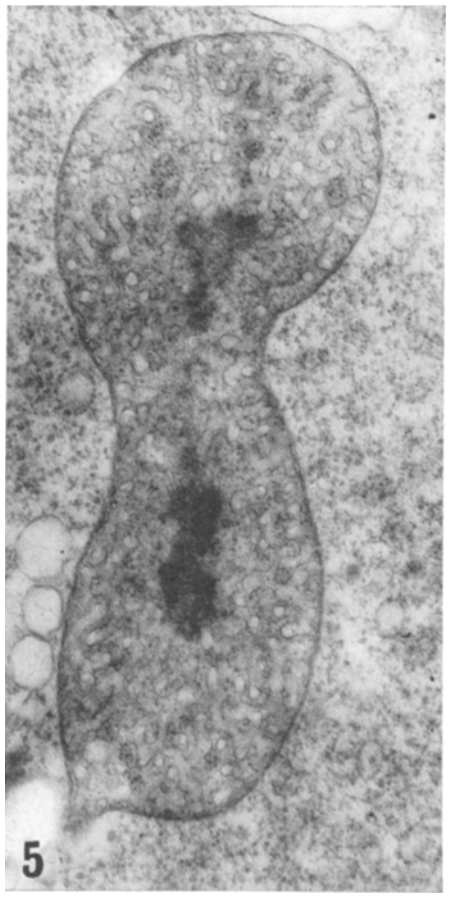

Fig. 5. Longitudinal section through dumbbell-shaped mitochondrion. Central body subdivided into two parts. × 28,500.

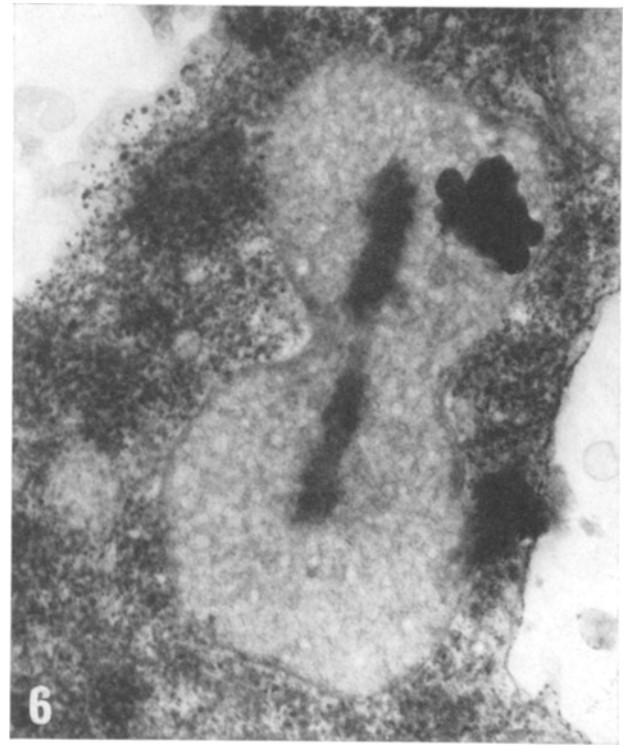

Fig. 6. Similar as in Figure 5, somewhat thicker section, showing a thin connection between 2 central bodies. Inclusion body in upper right corner. × 28,500.

Blum ultramicrotome, stained with lead acetate according to BJÖRKMAN[6], and studied with an electronmicroscope EMU-3F. Other explants from the same plasmodium were fixed with Champy's fixative and sections were stained with acid fuchsin according to ALTMANN[7]. Figure 1 shows, in a section stained with acid fuchsin, mitochondria of different shapes, varying from globular bodies to rod-like and dumbbell-shaped mitochondria which have a length of approximately twice the diameter of the globular bodies. The electronmicrograph in Figure 2 shows several mitochondria having the tubular structure that has been described before[8,9], and containing conspicuous central bodies. The central body is composed of fibers (Figure 3) which extend into the tubular region of the mitochondria. In Figure 4, a rod-shaped mitochondrion is seen containing a longitudinal central body. The dumbbell-shaped mitochondria in Figures 5 and 6 contain 2 central bodies each. The presence of 2 central bodies was found to be typical of dumbbell-shaped mitochondria.

Assuming that the mitochondria in *Physarum* might multiply by division, as they do in other organisms[10], it is tempting to speculate that, by morphological criteria, their central body behaves as a 'nucleoid' might be expected to behave. It is worth noting that the central body begins to divide before the division of the mitochondrion is complete (Figures 5 and 6). Thus, the division of the central body does not appear to be a passive result of being pinched into 2 pieces by the dividing mitochondrion.

A central body has also been described in Didymium[11], where there is strong evidence that it is composed of DNA fibers. It is not unlikely that such a body is ubiquitous for the myxomycetes, for a similar structure ('zentraler Bereich') has also been found in *Badhamia utricularis*[12,13].

Zusammenfassung. Zu den Mitochondrien des Schleimpilzes *Physarum polycephalum* wird ein fibröser Zentralkörper beschrieben. Zwischen seiner Form und derjenigen der Mitochondrien besteht eine Korrelation: In den Teilungsstadien der Mitochondrien scheinen diese Zentralkörper ebenfalls auf die beiden Teile im Sinne einer Durchschnürung aufgeteilt zu werden.

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