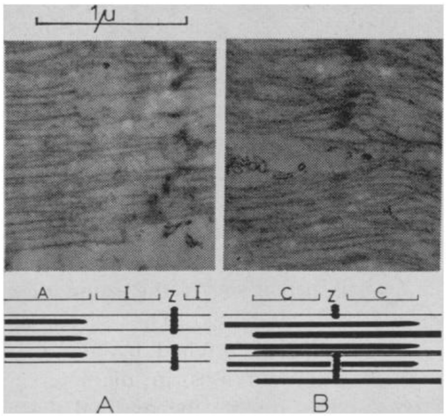

Fig. 2. Electronmicrographs of longitudinal ultrathin sections of *B. nubilus* muscle. (*A*) Partially contracted; the A-band is approaching the Z-band. (*B*) Contracted to the stage at which contraction bands (*C*) appear. The I-bands have disappeared and thick filaments have passed through spaces in the Z-disk into the next sarcomere. The region of overlap of thick filaments forms the contraction bands.

tion of the disk by the A-band filaments, can be tested by electron microscopy. Relaxed and contracted fibers were prepared for electron microscopic examination by osmium fixation and staining, followed by epon embedding and diamond-knife ultrathin sectioning. They were examined in a Siemens Elmiskop I.

In electronmicrographs the Z-bands are seen to be composed of a number of irregular bars about 0.5 μ long and 300 Å thick separated, even in weakly contracted sarcomeres, by spaces. When cut in certain places, the bars are simply transected and appear as large, round particles. Thin filaments are attached to the bars, and pass into the A-bands which are composed of 120-Å thick filaments (Fig. 2*A*). Although there is interdigitation of filaments, the array is not very regular, as it is in rabbit psoas and insect flight muscle. However, a clear zone of thin filaments, corresponding to the I-band region, is seen on either side of the Z-band in the extended and weakly contracted muscle. There are some unfilled spaces in this zone, and these probably correspond to regions opposite the spaces between Z-band bars.

The situation in the contracted fibril is strikingly different (Fig. 2*B*). The spaces between Z-band bars have increased in width and the original I-band region has been invaded by thick filaments. These have come to pass right through the perforations in the Z-bands, from both sides. The mechanism is illustrated in the diagrams below the electron micrographs in Fig. 2. It is evident that the contraction bands are formed by the overlapping of thick filaments passing across the Z-bands from adjacent sarcomeres. Probably not all the thick filaments succeed in finding spaces to go through. These become bent back in their own sarcomere.

In fibers contracted down to below 30 percent, the length referred to above is reduced. Thus there is no further overlap once the thick filaments approach those from the next-but-one sarcomere. They do not themselves shorten, but at this stage the filaments start to bend or to form a loose spiral. The filaments which have gone through the Z-disks are not well-oriented and may take up bizarre positions, becoming bent and pressed back against the Z-band.

These observations provide an explanation for the classically described changes (*6*) which occur in the banding of arthropod muscle during contraction and supercontraction. They also provide a striking confirmation of the sliding filament model of muscular contraction.

They do, however, raise a number of problems regarding the nature of excitation-contraction coupling, and the details of the interaction between filaments (*7*).

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3 July 1963

Indium Telluride Metal

Abstract. *Metallic indium telluride, InTe(II), is metastable up to 125°C at one atmosphere pressure. It has a cubic crystal structure and has a light blue color.*

The indium-tellurium temperature-pressure phase diagram (*1*) which shows a metallic phase above 32,000 bars has led us to attempt to isolate the metallic phase in a metastable state under ordinary laboratory conditions just as we isolated indium antimonide (*2*). This attempt has proven successful. The new metal is metastable to about 125°C, and has properties of considerable general interest. Its x-ray diagram shows it to be a simple cubic structure as reported earlier (*1*). Our parameters are given in Table 1. The lattice spacing is 3.07 Å corresponding to a theoretical density of 6.69 g/cm^3. Our density, directly measured, is slightly lower presumably because of imperfections in the crystalline compact arising from the high pressure preparation.

Indium telluride (I) was prepared by heating In and Te, each 99.999 percent pure, in an atom ratio of 1.000 to 1.000 ± 0.001, in an evacuated quartz tube, while being thoroughly mixed at approximately 100°C above the melting point of the compound (*3*).

Debye-Scherer x-ray diffraction patterns, Fig. 1, of the InTe(I) showed no lines attributable to In or Te above the background, thus indicating that the reaction was at least 98-percent complete.

Our technique for the preparation of metallic indium telluride, InTe(II), was similar to that used for the preparation of the indium antimony metal (*2*)—heating at high pressure to remove nucleation centers, followed by chilling with liquid nitrogen while under pressure, and subsequent pressure release and removal from the pressure apparatus. This metal is more easily isolated than indium antimonide. The latter requires temperatures below −63°C while the indium telluride is metastable at temperatures below about 125°C. X-ray diffraction of metallic indium telluride

Table 1. Lattice spacings of metallic indium telluride, InTe(II). The lattice spacing is 3.07 Å, theoretical density 6.69 g/cm^3, CuKα radiation.

h k l	*d* (Å)
100	3.056
110	2.174
111	1.773
200	1.536
210	1.374
211	1.255

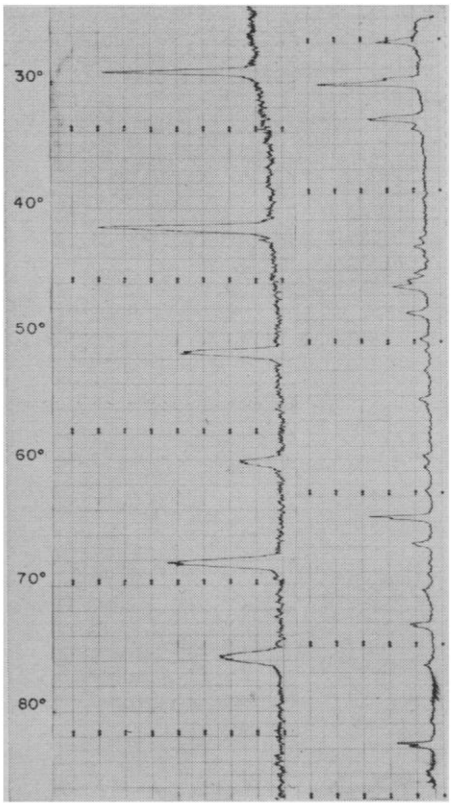

Fig. 1. X-ray diffraction patterns for allotropes of InTe; ordinate, degrees (2Θ); abscissa, relative intensity. Left trace: InTe(II), cubic form; right trace: InTe(I), tetragonal form.

taken at 25°C, Fig. 1, exhibits no diffraction lines corresponding to In, Te, or InTe(I) thus indicating that the conversion was essentially complete.

The cubic structure with six nearest neighbors causes an insufficiency in the valence electrons for covalent bonding, which we believe leads to a condition of resonance equivalent to the metallic state (*4*).

The physical properties are interesting. Whereas the InSb metal is very hard, nearly as hard as steel, the InTe metal is very soft and friable. It is readily scratched by glass. Our preparations have consisted of crystals of mean dimensions of 2000 Å as judged from the width of the x-ray lines.

The most remarkable of the obvious physical properties is the beautiful light blue color which the new metal shows on all its crystalline faces. This light blue metallic luster changes to a darker blue when the metal is cooled to −197°C.

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31 July 1963

Superconductivity of Metallic Indium Telluride

Abstract. *Metallic indium telluride is a superconductor with a transition temperature of 2.18°K. The critical magnetic field is about 800 gauss.*

Superconductivity in metallic InTe prepared and stabilized at atmospheric pressure in the way described by Darnell, Libby, and Yencha (*1*) has been observed by the same method as previously reported for the measurement of metallic InSb (*2*). In order to obtain a good filling factor for the measurement coil, seven specimens about 5 mm in diameter with lengths ranging from 1 mm to 12 mm were measured simultaneously. The total length was about 25 mm. The specimens were presumably polycrystalline.

The zero-field transition temperature T_0 appeared to be at 2.18°K and showed, contrary to InSb, a relatively sharp transition width of about 0.01°K. The sharpness of the transition might indicate that the specimens were not highly strained. Measurements in magnetic fields showed, as might be expected from the non-ideal geometry, that the intermediate state extended over a fairly wide range.

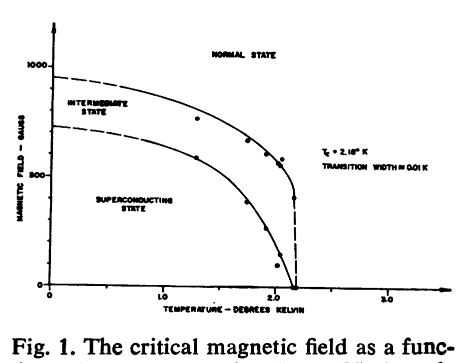

Fig. 1. The critical magnetic field as a function of temperature for InTe (II) (metallic indium tellurium).

The results are shown in Fig. 1. The lower curve represents the magnetic field at which normal conductivity started to appear at a given temperature. The upper curve represents the field at which the transition to the normal state was completed for the same temperature. Extrapolation of the curves to zero degrees would indicate a critical field $H_c(0)$ of about 800 gauss.

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31 July 1963

Cholinergic Substance in the Caudal Neurosecretory Storage Organ of Fish

Abstract. *Cholinergic substance exists in homogenates of caudal neurosecretory storage organs of fish. The caudal organs of fresh-water fish contain about 10 times the amount found in caudal organs of marine fish. The substance in the caudal organ of the carp is more than 100 times as concentrated as that in the brain.*

Several investigators have suggested that acetylcholine may play an important role in the mechanism releasing neurohormones from neurosecretory storage organs, such as the neurohypophysis, into capillaries (*1, 2*). This hypothesis is supported by the discoveries that the neurosecretory axon endings in the neurosecretory storage organs contain synaptic vesicles (*3*) which are thought to be the carriers of acetylcholine (*4*); that the synaptic vesicles change in size or number when neurohormones are released from the neurohypophysis into capillaries (*2*); and that acetylcholinesterase is present in the neurohypophysis of the cat (*1*). Until now, no study to detect acetylcholine or cholinergic substances in