slight extent. Except for some inhibition of *S. albus* by PCNB, all test organisms were unaffected by the three pesticides at the concentrations used.

The rate of degradation of DDT and PCNB by *S. aureofaciens* in culture was determined. At 2-day intervals, duplicate cultures were harvested, and the remaining pesticides as well as the products formed were extracted and determined by gas chromatography. The concentrations of PCNB or DDT decreased concomitantly with increases in the concentrations of their respective metabolic products. Maximum degradation, that is, 25 percent of DDT and 36 percent of PCNB, was attained in both cases within about 6 days.

The physical and chemical properties of the degradation product of PCNB closely resemble those of pentachloroaniline. Its ultraviolet-absorption spectrum, which differs from that of PCNB, is identical with that of pentachloroaniline, with peaks at 320, 240, and 220 mμ (Fig. 2). The pentachloroaniline and the metabolite had the same retention time, 3 minutes, with a gas chromatograph with a DC 11 column. The infrared-absorption spectrum of the degradation product corresponds exactly with that of PCA. The mass weight of the compound determined by mass spectrophotometry is 263 ± 1, and that of pentachloroaniline, 263. The melting point of each compound determined separately was 230° to 232°C; the mixed melting point was 230.5° to 232.5°C. Therefore, we conclude that the microbial-degradation product of PCNB is indeed pentachloroaniline.

This is the first report of soil microbes degrading DDT or of any microorganism degrading PCNB. Degradation of the pesticides in culture occurred only during the active growth phase of the actinomycetes or fungi, and stopped completely when growth ceased. Thus, the chlorinated hydrocarbon compounds were not utilized by these microorganisms as a sole source of carbon. Since microbes in soil tend to be largely inactive because of a deficiency of available carbon (*4*), these compounds persist in soil in spite of the presence of microorganisms that can partially degrade them.

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Molybdenum Diselenide: Rhombohedral High Pressure–High Temperature Polymorph

Abstract. *A three-layered rhombohedral form of molybdenum diselenide has been produced by subjecting the normal two-layered hexagonal form to pressures of 40 kilobars and temperatures of 1500°C. The new form is isostructural with rhombohedral molybdenum disulfide.*

A three-layer rhombohedral (designated 3R) form of molybdenum diselenide ($MoSe_2$) isostructural with rhombohedral molybdenum disulfide (MoS_2) (*1*) has been produced by subjecting the common two-layer hexagonal (designated 2H) form of $MoSe_2$ to high pressures and temperatures. The temperature-pressure conditions necessary for the transformation from the 2H to the 3R form are illustrated in Fig. 1, in which the phase boundary has been approximately located. The extent of conversion under various conditions was judged from x-ray powder photographs, where the new phase distinguished itself by lines indexable on the basis of a three-layer rhombohedral cell. In Fig. 1 solid shading indicates the production of a relatively pure 3R form, partial shading indicates a 2H and 3R mixture, and the open symbols represent a relatively pure 2H form. The reaction is sluggish and is not complete in a 1-hour heat. In the patterns from 6-hour heats we observed lines from either the 3R form or the 2H form, rather than mixtures. Two samples of the 3R form slowly reverted to the hexagonal form when held at temperatures about 200°C below the indicated phase boundary.

These experiments were performed with a girdle type of high-pressure system. The sample was contained in a boron nitride capsule ⅛ inch (about ⅓ cm) in diameter and ⅜ inch (about 1 cm) long. This was surrounded by a concentric graphite heater and pyrophylite pressure-transmitting medium. The overall dimensions of the high-pressure cell were ½ inch (about 1¼ cm) in diameter by ⅝ inch (about 1½ cm) long.

The pressure calibration of the apparatus was obtained at room temperature by using the resistance discontinuities in bismuth and thallium wires, encased in silver chloride, as fiducial points (*2*). The sample temperatures were calculated from the power consumption in the graphite heater. The temperature-power relationship was established in calibration tests in which platinum–platinum rhodium thermocouples were located in the center of the sample cell. The accuracy of the calibrations was checked by observing the melting point of germanium as a function of pressure. The results agreed with published data within about 5 percent (*3*). Corrections were not made for the effect of pressure on the thermocouple electromotive force or for the error in the pressure scale used by Hall (*3*), since these errors were less than the typical scatter expected in the experimental conditions (±50°C and ±1 kb).

The physical properties of the new rhombohedral form of $MoSe_2$ have not been measured. Outwardly it is nearly indistinguishable from the normal hexagonal form, having a pronounced graphitic appearance. It is expected that

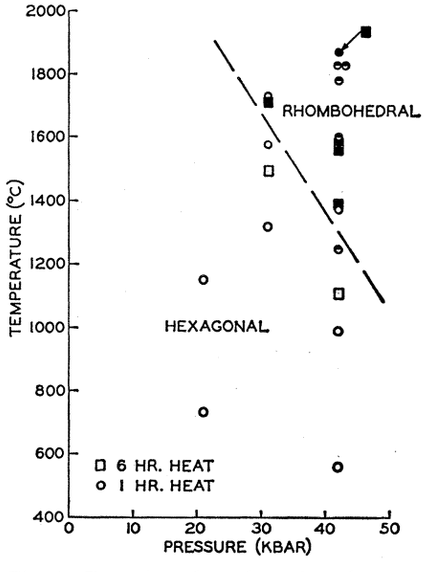

Fig. 1. Tentative phase boundary between the rhombohedral and hexagonal forms of MoSe (see text).

the new form will be found to be a semiconductor, as are the hexagonal forms of both $MoSe_2$ and MoS_2 (*4*).

The powder pattern of the 3R form is indexable with the assumption of a three-layer rhombohedral cell ($-h+k+l \neq 3n$ absent, hexagonal axes) in which lines with $-h+k \neq 3n$ are diagnostic of the new form. As conversion occurs the diagnostic lines for the 2H form disappear and are bracketed by a pair of lines from the 3R form. Thus in the zone $h0 \cdot l$ the line $(10.3)_{2H}$ disappears and is replaced by $(10.4, 10.\bar{5})_{3R}$, and $(10.5)_{2H}$ disappears and is replaced by $(10.7, 10.\bar{8})_{3R}$.

There is good agreement between observed and calculated structure factors for the diagnostic reflections (Table 1). The atomic positions are like those in 3R MoS_2, with space group R3m, and all atoms on 3 (a). Intensities were calculated by using Mo in ⅓, ⅔, 0; Se_1 in ⅔, ⅓, .083; and Se_2 in ⅓, ⅔, .250. Intensities were measured from peak heights on a diffractometer trace (0.4° and 0.2° per minute scanning speed) and corrected for Lorentz and polarization factors. Scattering factors were derived from Thomas and Umeda (*5*).

The lattice parameters for 3R $MoSe_2$, calculated from six of the large (76° to 80°) θ lines, are $a = 3.292$ Å and $c = 19.392$ Å (thickness of one layer = 6.46 Å). These values are similar to those reported for the 2H form (*6*), for which $a = 3.288$ and $c = 12.931$ Å (thickness of one layer = 6.46 Å). Calculated interatomic distances of nearest neighbors are the same as those of James and Lavik (*6*) since our unrefined z coordinates are the three-layer equivalents of their two-layer values.

Table 1. Observed and calculated structure factors for the 10. *l*, 20. *l*, and 21. *l* zones $MoSe_2$ (sec text).

hk.l	A	B	$F_{calc.}$	$F_{obs.}$
10. 1	−40	−11	41	55
10. 2	−31	+ 7	32	34
10. 4	− 2	+52	52	55
10. 5	+ 7	+67	67	63
10. 7	+ 6	+63	63	56
10. 8	− 2	45	45	41
10.10	−24	44	50	69
10.11	−31	− 7	32	38
10.13	−29	− 6	30	34
10.14	−22	+ 5	23	35
10.16	− 2	+36	36	63
10.17	+ 4	+45	45	61
10.19	+ 4	42	42	44
20. 1	+31	+ 8	32	46
20. 4	− 3	−41	41	40
20. 5	+ 6	−52	52	47
20. 7	5	−51	51	43
20. 8	−2	−39	39	34
21. 5	+ 4	+44	44	39
21. 7	+ 5	+44	44	31
21.13	−24	− 4	24	24

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Nucleohistone Dissociation by Ganglioside Micelles

Abstract. *The sialic acid–containing glycosphingolipids known as gangliosides can reverse the heat stabilization of DNA by histones. The ability of pure mono- and disialogangliosides to dissociate reconstituted nucleohistone is directly dependent on their sialic acid content; they are effective in concentrations above their critical micelle concentration.*

It is established that DNA is rendered less effective as a template for RNA synthesis in vitro when histones are added (*1*), and that removal of histones from chromatin preparations stimulates template activity (*2*). Such findings suggest that histones may function as repressors of DNA expression, and that disruption of the nucleohistone complex may constitute derepression. Mechanisms for the dissociation of nucleohistones are therefore of considerable current interest.

Frenster (*2*) has reported that addition of polyanions to chromatin increases its effectiveness as a template for RNA synthesis, and that "active chromatin" isolated from calf thymus has a higher content of polyanions than has "repressed chromatin." The polyanions probably function by changing the electrostatic attraction between DNA and histones. Gangliosides are anionic neuronal glycolipids, which have been shown to form complexes with basic proteins, including histones (*3*). McIlwain has demonstrated migration of histones from the nucleus to ganglioside-rich membranes in brain slices briefly exposed to cold (*3*). Thus it was considered of interest to determine whether gangliosides can interact directly with nucleohistones. We have observed that four pure gangliosides compete with DNA for its associated histones, as evidenced by reversal of the heat stabilization of DNA by histones.

Nucleohistone was prepared from calf-thymus DNA (*4*) and calf-thymus lysine-rich histone (*5*) by a method described (*6*). DNA (61.5 μg) and 114.0 μg of histone were dissolved in 4.0 ml of dilute saline-citrate buffer (2.8 m*M* NaCl, 3 m*M* sodium citrate, *p*H 7.3). Nucleohistone solutions were prepared by sequential addition of 0.4 ml of DNA stock (154 μg/ml), 3.05 ml of buffer, and 0.55 ml of histone stock (208 μg/ml). When the sample included ganglioside, a portion of $10^{-3}M$ ganglioside was subsequently added to the above mixture. The volume of buffer was reduced to maintain a final volume of 4.0 ml. By this procedure, precipitation of the complex was avoided. *N*-Acetylneuraminic acid (NANA) was determined by the modified resorcinol method (*7*). Gangliosides were isolated from human brain in a manner described (*8*).

The helix-coil transition of DNA was observed by measurement of the accompanying hyperchromic shift at 260 mμ. Samples were heated in the Beckman-DK2 recording spectrophotometer by means of an aluminum heating block; optical density (O.D.) was measured at ambient temperatures. T_m is defined as the temperature at which half the total hyperchromicity is reached. The percentage of total hyperchromicity reached at 74°C was determined in some experiments as

$$[\text{O.D. (74°C)} - \text{O.D. (25°C)}]/[\text{O.D. (98°C)} - \text{O.D. (25°C)}] \times 100$$

This determination requires O.D. measurements at three temperatures only. Samples containing gangliosides were always compared with blanks of identical ganglioside concentration.

Under the ionic conditions of these