continued for 300 additional trials. Forty transfer trials were then given; in these the monkey was made to use the untrained hand. Choice of the positive object was still rewarded.

Table 2 shows the results (*6*). Only animal 3 performed at a level significantly better than chance with the previously untrained hand.

Macroscopic examination of the brains of the five animals indicates that in two of the animals the corpus callosum (including genu and splenium) was cut completely; that some few fibers may possibly have remained intact at the posterior end of the splenium in animal 8; that one bundle (approximately 3 mm front to back and less than 1 mm top to bottom) in the genu and another (approximately 3 by 1.5 mm) at the level of the red nucleus remained intact in animal 1; and that a small portion of the ventral genu was not cut in animal 3. There was also variable unilateral destruction of the cingulate gyrus, the septal cortex, the caudate nucleus, and the fornix, with occasional minor degeneration elsewhere (for example, in the dorsomedial nucleus, the orbital cortex, and the anterior commissure).

Myers (*3*) has reported that transfer between the hands persists in the monkey (at least in the case of roughness discriminations) if training with the first hand is carried out before, not after, the callosum is cut. Therefore, it is possible that performance of the bimanual skill would have been more consistently impaired by surgery if all five animals had been trained only after callosal section and appropriate animals from outside the experimental group had been used as controls. However, the available evidence suggests that the callosum is not involved in the learned coordinations required in the performance of bimanual skills. The results reported here indicate, as has previously been reported by others, that the callosum is involved in the transmission of tactile learning between the hemispheres. Nevertheless, the good performance of animal 3 (unless it be supposed that this is not a transfer effect but merely a spontaneous preference of the "correct" object) supports the view of Glickstein and Sperry (*7*) that alternative pathways exist for such transmission (*8*).

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5. The animals were trained to a level of performance of 90 correct responses in 100 trials (animals 3 and 6 were trained to a level of 90 percent correct responses in 200 trials during initial learning). The trials on which the animals reached the criterion of learning are excluded from the scores.
6. In 45 of the 200 trials on transfer testing there was evidence of position habits (defined as ten or more consecutive responses to the same side).
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8. Financial support for this work was provided by the Research Fund of the Institute of Neurology and by the Medical Research Council. We are greatly indebted to Dr. Marion Smith, who kindly examined the brain slices with us, and to Professor R. W. Gilliatt for his support.

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Thermal Properties of Meteoritic Iron from —150° to 300° Celsius

Abstract. *Thermal diffusivity and specific heat have been measured by the flash method on a small specimen of meteoritic iron from the Canyon Diablo fall. Measurements have been made over the temperature range −150° to 300°C from which thermal conductivity values have been calculated.*

Meteorites enter the earth's atmosphere from many different angles and velocities which produce very different rates of aerodynamic heating, extending from complete combustion as seen in meteors to meteorites which fell so slowly that they were barely warm when they reached the surface of the earth. These objects offer a novel field for examining different reentry effects.

To evaluate the effect of aerodynamic heating and the subsequent ablation process upon the bulk of the meteorite, it is necessary to determine the thermal diffusivity of the material as a function of temperature. There are few published data in this area (*1*), largely because meteorites are rare objects, and are especially difficult to cut in the usual forms required for thermal measurements.

A flash technique, developed in this laboratory (*2*), makes it possible to measure thermal properties as a function of temperature on small samples which can be readily cut from meteorites as small as a few inches across. One side of the specimen is rapidly heated with a pulse of thermal radiation from a high intensity xenon flash lamp and the resultant temperature history of the opposite side is determined by fine thermocouple wires pressed against the surface. The thermal diffusivity (α) is then

$$\alpha = 0.139\, L^2/t_{\frac{1}{2}}$$

where L is the thickness of the specimen and $t^{1/2}$ the time for the temperature rise to reach one-half of its maximum value. If the side of the sample exposed to the lamp is blackened with carbon deposited from burning camphor or any other black material, and the radiant energy falling on the surface is known, then the product of the density of the material and the heat capacity can be measured from the maximum temperature rise. This follows from the relationship

$$Q = mc/\Delta T$$

where Q is the number of calories absorbed by the specimen, m its mass in grams, c its heat capacity in calories per gram, and ΔT the maximum change in temperature due to the flash. Energy calibrations are made by exposing thin specimens of pure silver, blackened in the same manner, and noting the maximum temperature rise.

The thermal conductivity is calculated from the preceding values by the relationship

$$K = \alpha\rho c$$

where K is the thermal conductivity and ρ is the density. Values for different temperatures are found by heating the specimen above ambient with a resistance heater and cooling below ambient by surrounding the vacuum chamber with liquid nitrogen.

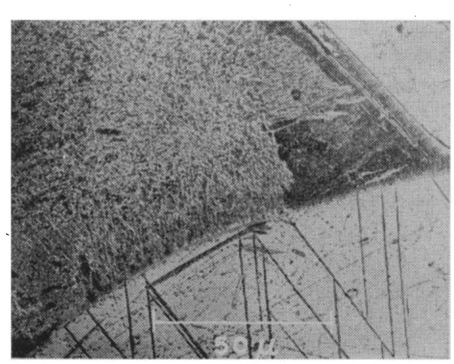

Fig. 1. Photomicrograph of granulated plessite field after temperature cycles from −180° to 300°C. Neumann lines in the lower part retain their original sharpness.

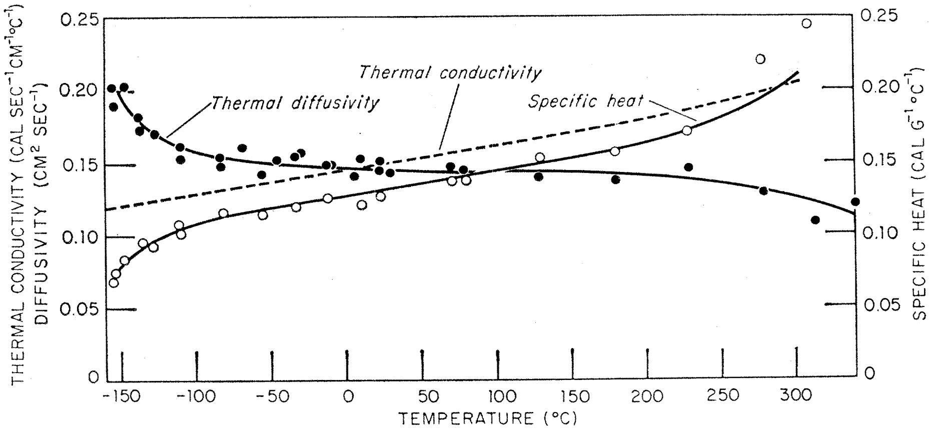

Fig. 2. Graph of experimental results for specific heat and thermal diffusivity. Dotted curve is calculated thermal conductivity.

The specimen used in this work was cut from one of the many pieces of the Canyon Diablo meteorite fall. This iron is an octahedrite which is a two-phase alloy, composed of low nickel kamacite and high nickel taenite. A square sample was cut measuring 2 cm on a side by 1 mm thick. It was ground on a surface grinder, the specimen being held with a magnetic chuck, until both sides were flat and parallel. The density of the specimen, from careful measurements of its dimensions and weight, was found to be 7.81 at room temperature. Examination of the specimen under the microscope did not reveal the presence of inclusions of troilite, schreibersite, or cohenite.

This thin section of meteoritic iron is presumably in its original state, that is, as it was before entering the earth's atmosphere. This is evidenced by the fact that the specimen was cut well below the surface, as well as by the appearance of the Neumann lines in the kamacite phase. There was no sign of granulation, characteristic of kamacite after it has been heated, either naturally or artificially. Structural changes occur in these meteorites when heated above approximately 400°C, and since none was observed, we assume that this specimen was thick enough so that aerodynamic heating did not penetrate to the depth from which the specimen was cut. If it were heated to this depth, then it must have been for a short time only, since such changes are both time and temperature dependent.

The photomicrograph shown in Fig. 1 is of the etched surface of the specimen used in these measurements taken after all temperature cycling was completed. The temperature was raised and lowered from 300° to −180°C several times during the course of the experiments, a range of temperature which we assumed would not cause any structural alterations to take place in the alloy.

However, it can be seen that the plessite field is thoroughly granulated, hence it may be concluded that some changes did take place over this temperature range. There is some evidence of incipient changes in the taenite phase as shown by patches of slight granulation brought out by the etching which is not clear in the picture. Despite these slight structural changes, the Neumann lines retain their original sharpness, indicating that no gross changes have occurred in the kamacite phase.

The results for thermal diffusivity and heat capacity and the calculated thermal conductivity as a function of temperature is shown in Fig. 2. Little weight is attached to the last two points in the specific heat curve, because at the higher temperatures carbon blacks tend to flake so that the absorption of the radiant energy by the specimen may not have been equal to that of the standard.

The results reported here on the thermal properties of meteoritic iron from −150° to 300°C are believed to represent those existing in the material prior to its encounter with the earth.

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Tuberculin Hypersensitivity: Studies with Radioactive Antigen and Mononuclear Cells

Abstract. *The type and fate of mononuclear cells of guinea pigs hypersensitive to tuberculin were studied by means of purified protein derivative labeled with I^{125} and mononuclear cells labeled with tritiated thymidine. Purified protein derivative labeled with I^{125} was taken up in vitro by lymphocytes and neutrophils from animals that were either sensitive or nonsensitive to tuberculin, but it was bound more frequently by the cells of sensitive animals. Passive transfer of tuberculin hypersensitivity by means of lymphocytes labeled with tritiated thymidine indicated that significant numbers of radioactive cells migrated to the site where the skin was tested with purified protein derivative only when the test was made immediately after transfusion. Although skin reactions from tests made with purified protein derivative 24 hours after transfusion were comparable to those from tests made immediately, the number of labeled cells at the sites of the later tests was not consistently larger than it was in controls (Histoplasmin reactions). Thus transfused tuberculin-sensitive cells are neither always attracted to the sites of the test with purified protein derivative nor are they required in large numbers at the site for a positive reaction to develop.*

Neither specific identification of the cells reacting with tuberculin antigens nor clarification of their role in delayed cutaneous hypersensitivity has been achieved. In 1932 Rich and Lewis (*1*) showed that tuberculin was toxic for cells from tuberculin-sensitive animals. Favour (*2*) then reported that these cells were neutrophils in the guinea pig and small lymphocytes in the mouse and guinea pig. It was later noted that the affinity of leukocytes for tuberculin did not depend on an active tuberculous infection but was naturally present in species capable of showing a tuberculin reaction (*3*). Turk (*4*) found a greater uptake of purified protein derivative (PPD) labeled with I^{131} by sensitive lymphocytes but observed no qualitative difference in reacting cells from sensitive and nonsensitive animals.

Since 1945 when Chase (*5*) demonstrated that cutaneous tuberculin hypersensitivity could be passively transferred by lymphoid cells, there has been disagreement about the fate and func-