and cardiopulmonary responses. Once again it was emphasized that the 2- to 5-month period may well be a transitional period between the neonatal and the more mature infant response, and that this possibility merits a great deal more study.

The conference brought together for the first time a variety of individuals interested directly or indirectly in the problem. The interchange revealed, as I have indicated, a number of gaps in basic information concerning infant development. One is startled to find that the number of infants who die of sudden-death syndrome is comparable in order of magnitude to the number of adults who die from carcinoma of the lung. Despite this fact, the epidemiological information is miniscule in comparison to that on carcinoma of the lung. The questions raised by the conference should provide a stimulus for more comprehensive and detailed studies of the areas indicated, including cooperative investigations on the epidemiology in this and other countries.

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Calorimetry

In order to report new developments in thermodynamics and thermochemistry, to develop cooperative schemes for improving the acquisition and dissemination of thermodynamic data, and to exchange views on techniques, the 18th Annual Calorimetry Conference was held 16–18 October in Bartlesville, Oklahoma, at the Bureau of Mines Petroleum Research Center. This conference was the first to be held at the home laboratory of its founder, the late H. M. Huffman.

The keynote address, "Some legacies of H. M. Huffman to calorimetry and thermodynamics," was delivered by John P. McCullough (Socony Mobil Oil Co.), a successor of Huffman as director of the laboratory. He described the (i) development of a model laboratory and (ii) the method of obtaining coherent and comprehensive thermodynamic data by a coordinated series of various kinds of experiments upon carefully selected classes of compounds. This approach, initiated by Huffman and continued by his successors, has resulted in such outstanding contribu-

tions of thermodynamic data that it has become a model of its kind, widely copied and of great influence in its field.

The problems of making high-temperature enthalpy measurements have been increasing because of the materials requirements of the space era. E. D. West (National Bureau of Standards) discussed such problems and illustrated them by describing a new adiabatic "lift" (as contrasted to "drop") calorimeter for measuring enthalpies to 2500°C. Obtaining valid measurements of any degree of accuracy at these temperatures is a problem but West has obtained measurements with errors as low as 0.1 percent. To do so he has incorporated automatic photoelectric pyrometry for temperature measurements and furnace temperature control precise to 0.05°C to heat the sample, and a method of making heat measurements with varying amounts of material in the "lifted" capsule. The latter technique gives differential measurements which eliminate some variables not easily controlled or measured.

In a discussion on the low-temperature heat capacities of superconductors, F. J. Morin (North American Aviation Science Center) showed how it has been possible to map the energy levels of the *f*-band of electrons in a series of transition metals by measuring the temperature dependence of the electronic contribution to the heat capacities in the elements and intermetallic compounds of the series. His correlations were remarkably good. The heat capacities of superconductors have contributed much of the essential quantitative information leading to the nature of superconductivity. The heat capacities of "hard" superconductors are of particular interest recently because material of this type is used in high-field solenoids. Work by E. J. Ryder (Bell Telephone Laboratories) on V_3Si and V_5Si_3 and by B. Serin and G. T. McConville (Rutgers University) on Nb and Nb-Sn alloys have added further valuable data on the low-temperature heat capacities of this class of substances.

P. Dean (National Physical Laboratory, England) delivered a very graphic lecture and was careful to preface his remarks with a statement that he is a mathematician and is really not very much interested in calorimetry. Nevertheless, his analysis of the vibrational frequency spectrum of linear lattices of light and heavy atoms was a clear interpretation of the heat capacities of solids. His method of analysis, utilizing machine computation to work out the

tedious arithmetic, allows the variations in the spectrum to be readily followed as changes are permitted in the relative proportions and masses of light and heavy atoms in the lattice. The heat capacity, at least in its broad pattern, is readily derived, of course, when the frequency spectrum is fully known.

Of particular interest to calorimetrists is the accuracy of the temperature scale because the validity of most measurements is dependent upon it. J. L. Riddle (National Bureau of Standards) discussed the changes in the International Practical Temperature Scale proposed by the Advisory Committee on Thermometry of the International Bureau of Weights and Measures. These changes, currently the subject of intense work in several laboratories, would extend the International Practical Temperature Scale below the oxygen point to the hydrogen triple point, would extend the platinum resistance thermometer scale upward to 1063°C, and make several minor adjustments of defined fixed points. The object of the change is to create an International Practical Temperature Scale as close to the thermodynamic scale as can be done in the light of current knowledge. The prospect of making these changes within the next few years should stimulate studies to indicate whether or not the proposed changes are consistent with the best thermodynamic data.

An illustration of the lack of consistency in the present scales was given by G. T. Furukawa (National Bureau of Standards), who showed constistent deviations in correlations of low-temperature, heat-capacity data based on the temperature scales. When the experimental data are analyzed on the basis of the observed resistances of the thermometer instead of converting to temperatures, the deviations are eliminated. The deviations observed are attributed to inconsistencies in the dR/dT derived from the temperature scales.

In the calorimetry of reacting systems, P. Gross (Fulmer Research Institute, England) illustrated how, with apparatus of utmost simplicity, it is possible to obtain accurate heats of combustion of metals in fluorine or chlorine. The use of fluorine in bomb calorimetry was further illustrated by E. Greenberg, H. A. Porte, and W. N. Hubbard (Argonne National Laboratory) who described the heats of formation of pentafluorides of Nb, Ta, and Ru. W. D. Good, M. Mansson, N. K. Smith, and J. P. McCullough (U.S. Bureau of Mines, Bartlesville) showed that

the thermochemistry of boron, long a troublesome element for calorimetrists, can be handled with high precision in a rotating bomb calorimeter. They are able to burn organo-boron compounds completely and form a homogeneous, well-characterized final state by converting the boron to fluoroboric acid in aqueous solution.

A principal factor impeding measurements on the combustion of metals and refractory solids in a bomb calorimeter has been the inability to observe the actual combustion. Slow-motion pictures taken of combustion in a bomb with a window were shown by C. E. Holley, Jr. (Los Alamos Scientific Laboratory). This method, while not in any sense a calorimetric method, may result in devising a system for heat measurements which are traditionally very difficult because complete and reproducible combustion cannot be obtained easily.

In discussions of solution calorimetry, L. A. K. Staveley (Oxford) and K. W. Dunning (University of Bristol) presented very ingenious studies on the energies of complex formation of metallic ions in combination with organic ligands; students of Cobble (Purdue University) reported on precise determinations of specific heats of aqueous salt solutions.

Dealing with calorimeters for measuring radiation dose, P. Nagl (International Atomic Energy Agency, Vienna) and E. Schleiger (U.S. Radiological Defense Laboratory) described calorimeters for measuring absorbed dose in rads (a rad is 100 erg/g); this device has received increasing attention during the past 5 years.

Many important new contributions in the field were noted at the conference; there were altogether a total of 51 papers. Several informal discussion groups were set up; their general topics and moderators included: experimental techniques in enthalpy measurements, E. F. Westrum (University of Michigan); experimental techniques in bomb calorimetry, W. N. Hubbard; standard reference materials for solution calorimetry, S. R. Gunn (Lawrence Radiation Laboratory); and classification of calorimetric data for publication and retrieval, G. T. Furukawa.

The Phillips Petroleum Company was joint host for the conference; J. A. Morrison (National Research Council, Canada) was conference chairman.

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