segregation of such papers in a separate journal or section of a journal in which quality must be provided by appropriate editorial policy. No action was taken but the consensus was that the problem merits further study.

An appeal to authors was made by Rachel Dudley (National Bureau of Standards) to report all vital information in their publications and to cooperate with the data-compilation group by submitting to it unpublished data.

In addition to the laboratory tours and technical sessions, a business meeting was held. The following officers were elected: R. Hultgren (University of California), chairman-elect; D. C. Ginnings (National Bureau of Standards), S. Sunner (University of Lund, Sweden), and C. E. Vanderzee (University of Nebraska), new members of the board of directors. Also at the business meeting two resolutions were made by the conference concerning standard samples: First, because of the rapid depletion of a Calorimetry Conference sample of aluminum oxide, which is used as a standard in heat capacity measurements, the National Bureau of Standards will be asked to add a suitable sample of aluminum oxide to their standard sample program. Second, because of the need for standards to be used in reaction calorimetry and the apparent suitability of the reaction of THAM with aqueous HCl as a standard reaction, the National Bureau of Standards will be asked to add a suitably purified sample of THAM to their standard sample program.

The 1965 Calorimetry Conference will be held at Iowa State University, Ames. Program chairman for the meeting will be Ralph Hultgren (University of California, Berkeley), to whom inquiries should be addressed.

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Bioastronautics and Space

Unusually free exchange of experiences and ideas between American and Russian space scientists was a highlight of the third international symposium on Bioastronautics and the Exploration of Space, sponsored by the U.S. Air Force Aerospace Medical Division and arranged by Southwest Research Institute. The symposium attracted over 600 scientists, physicians, and engineers from all over the world to San Antonio, Texas, 16–18 November 1964. At their request, the three Russian representatives held two private sessions with their American counterparts; there was free discussion on the basic level. One American scientist attending said that he had been at most of the space meetings, including that at Warsaw this year, and had never seen such willingness to trade data and explore problem areas.

Certain problems which took high priority at the previous meeting in 1958 seemed less formidable. James A. Van Allen (State University of Iowa) stated that, although the earth's magnetosphere does trap particles, they are of relatively low energy and easy to shield against; he also predicted that a successful Mariner probe will show a similar field of particles trapped in the magnetosphere of Mars. Fred A. Whipple (Smithsonian Astrophysical Observatory), who had previously seen the possibility of meteors bombarding spacecraft, cited the Echo balloon which orbited over the meeting area daily as proof that earlier fears were almost groundless. Solar flares were still seen as a threat by John W. Firor (High Altitude Observatory, Boulder, Colo.), but he said that a study now underway may permit predictions of 14-day safe periods which would be sufficient time for the protection of men in a landing module or in space suits after their landing on the moon.

Moon explorers probably will not need to worry about volcanic eruptions, according to Ewen Whitaker (University of Arizona), one of the key men in the Ranger program; he said that the observed apparent eruptions may be the results of puncture by meteorites of pockets of trapped water vapor and gas. Even the costs of space research were not regarded as prohibitive: Edward Welsh, executive secretary of the President's Aeronautics and Space Council, predicted a continued budget level. Krafft A. Ehricke (General Dynamics/Astronautics) described studies of projected moon and planetary surface exploration to 1978; the peak year would be 1975–76, with a budget of over $8 billion. "Fate has given this nation a chance for remarkable space pioneering," he said. "And it has been done without anyone having to sacrifice one cigarette, one tube of cold cream, or one evening at a night club." Other problems still remain, and the laboratory does not seem to be the place to solve them. Columbus had his egg, but no one was convinced until he came back; scientists on both sides of the Iron Curtain seem to feel that simulation may help, but there is nothing like the real experience of spaceflight.

Juergen Aschoff (Max Planck Institute) indicated that circadian rhythms, unlike faucets, cannot be turned off and on. Among the 50 functions graphed so far, he said, indications are that remarkable changes develop from the maximum in the morning to a minimum reaction time in the afternoon. Efficiency of an astronaut may suffer from these earth-bound mechanisms even when he is in the daylessnightless void of space. Aschoff suggested that a conditioning program based on submultiples of the 24-hour cycle be inaugurated; six 4-hour cycles were suggested. However, only time and space will tell.

The inner ear, which has received much press attention, was still seen as a problem area by Ashton Graybiel (U.S. Navy); he predicted that when previously couch-bound U.S. spacemen have the opportunity to move their heads around, nausea and disorientation may result. He suggested drugs and conditioning as possible remedies.

Confining space suits of U.S. astronauts were criticized by M. Scott Carpenter and Charles E. Yeager, who called for less-confining garments. They were heartened by the report of Herbert H. Reynolds (Holloman Air Force Base) that chimpanzees had withstood vacuum for as long as 15 seconds, which would be enough time to retreat to safety or repair a cabin puncture. The Russian scientists revealed at a press conference that all three men in Voskhod had been in a shirt-sleeve environment from launch to touchdown. Carpenter also called for removable sensors (which the Russians said they had) and less activity for the astronaut, a complaint echoed by the scientists who planned the Vostok and Voskhod flights.

The arrival of the Russian scientists, all members of the staff of the Institute of Normal and Pathological Physiology, caused some concern for the arrangers of the symposium. They had been invited months in advance, but the late grant of visas and the even later knowledge (on arrival at the air-

port) that they were going to present three papers necessitated considerable readjustment of the schedule; fortunately, three Russian interpreters from the Library of Congress, Boris Mandrovsky, Daniel Pyle, and Christopher Dodge, were in attendance and performed admirably. The Russians, an integral part of Soviet space research, were O. G. Gazenko, V. V. Antipov, and M. M. Kazenkov. They arrived from New York sitting across the aisle from Scott Carpenter (from Houston), without mutual recognition until they went down the ramp to face the news cameras and the welcoming committee headed by Hubertus Strughold, chairman of the meeting.

The main concern of the Russians was weightlessness. Gazenko related individual differences in response but stated that most cosmonauts had felt strange reactions to the condition; while sometimes pleasant, it also became uncomfortable. Illusions of body motion and deconditioning of the circulatory system similar to that suffered by the bedridden were noted. Inner ear effects and functional reactions of the central nervous system, metabolism, and cardiovascular system lasted as long as a week in some cases.

V. V. Antipov related fruit-fly experiments which were the precursors of manned space flight; overproduction of females was first thought to result from weightlessness, but is now believed to be caused by heavy cosmic-ray particles. Kasenkov, a mechanical engineer who became interested in visual problems in space, reported that weightlessness had little effect on vision, but that stress beyond $2g$ did.

Space cabin atmospheres also came into the discussion. The Aerospace Medical Division was concurrently conducting a closed-system experiment using a mixture of oxygen and helium. Gazenko admitted that the Russians had been restricted to simulation of Earth's atmosphere. "In future flights," he said, "a new type of gas environment must be used."

Respect for the arts and humanities was voiced by banquet speaker Martin Goland (Southwest Research Institute) who decried the concept of manned spaceflight as the opportunity to put a better computer aboard:

"The tragic paradox of our times is that our technological experiences have added imbalance to our lives. Science and technology rush forward while ethics and the humanities advance only at their prespace historic slow pace. It may seem absurd at first glance, but we should consider sending artists, poets, and philosophers into space. Man and not instruments alone must be our guide as we search out the secrets of the heavens."

The proceedings of the symposium, 33 papers, will be published during 1965, probably as an Air Force document.

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Lactic Acids: Chemistry and Metabolism

It is not always fully appreciated that lactic acid is a mixture of two isomers, each of which is disposed of in a different manner by the body and which therefore need to be studied separately. The chemistry and metabolism of these isomers were the subject of a conference held in New York City 12–14 November 1964.

The first speaker, L. B. Lockwood (Miles Chemical), reviewed and corrected available information on the physical chemistry of lactic isomers and polymers. Infrared absorption spectra of various hydroxy acids were presented as evidence of the existence of an ethylene oxide form when free lactic acid is present in solution, as originally proposed by Bancroft and Davis in 1931. Downward correction of the value of the pK_a of lactic acid to 3.73 at 25°C was proposed on the basis of data obtained with purer preparations of lactic acid than were previously available. The phenomenon of spontaneous polymerization in lactic acid solutions with concentrations greater than 30 percent was emphasized. This raised the practical problem that the 40-percent, or 85- to 90-percent lactic acid which manufacturers persist in supplying as a commercial reagent must be depolymerized before use. There is current interest in potential applications of larger polymers of lactic acid.

Attention was directed to the properties of lactic dehydrogenase (LDH) enzymes. D. Dennis (Brandeis) presented evidence for two mechanisms of racemization of lactic acid in bacteria, one proceeding directly and the other via pyruvate. The values for Michaelis's constant (K_m) were identical for each of the lactic isomers in the former case. J. McD. Armstrong (Harvard University) discussed the complex L-LDH system of yeast that was crystallized by Appleby and Morton and is known as cytochrome b_2; this is a hemochromogen containing flavin mononucleotide. Since the enzyme converts lactate to pyruvate quantitatively, in the assay of L-lactate it has advantages over the mammalian enzymes dependent on nicotinamide adenine dinucleotide (NAD).

T. Fondy (Brandeis) reviewed the properties and roles of the five molecular forms of NAD-linked L-LDH enzymes from various species. This subject merits more consideration by workers studying L-lactate metabolism in the whole animal, who frequently tend to regard L-LDH as a single entity. It was brought out in discussion that intracellular distribution of the different forms of L-LDH has not yet been studied.

E. S. Kline (Medical College of Virginia) introduced the ticklish subject of induction of enzymes in *Escherichia coli*, using L- and D-LDH as examples; evidence presented showed that L-LDH is an inducible enzyme while D-LDH is not. More surprising was the observation that D-lactate is even more effective in inducing L-LDH than is the natural substrate, L-lactate.

Moving on to metabolism in higher systems, P. K. Tubbs (Cambridge, England) presented a stimulating historical review of lactate metabolism, with emphasis on the "unnatural" (for higher organisms, at least) isomer D-lactate. He amplified his previous reports on the mammalian mitochondrial enzyme D-LDH and provided valuable orientation on possible roles for the enzyme in the metabolism of certain amino acids. This theme was emphasized by Gordon (Monsanto), who reported on pathways for L- and D-hydroxy acids that could serve as precursors for certain essential amino acids. M. Brin (Upstate Medical Center, Syracuse, N.Y.) described a method of synthesizing D- and L-lactic acids labeled with C^{14} and discussed their utilization by mammalian and avian tissue slices from various organs. Most intriguing was his finding that several tissues used the D-isomer at rates much faster than could be explained by the appearance of the C^{14} as CO_2, suggesting, perhaps, that most of the product formed from D-lactate was used in a pathway of synthesis. O. N. Miller (Tulane) discussed the possible sig-