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LETTERS
Laboratory Decontamination: M. Castegnaro; Science and Technology Awareness Month: A. W. Trivelpiece; Animal Rights Movement: J. E. McArdle; EDB Alternatives: S. L. Sauter et al.; Gene-Splicing Experiment: T. Suslow

EDITORIAL
Spacelab 1

ARTICLES
Amazon Basin: A System in Equilibrium: E. Salati and P. B. Vose
Genetic Screening: Marvel or Menace?: P. T. Rowley

NEWS AND COMMENT
Reagan Seeks Expansion of Soviet Ties
OTA Questions Space Station
Zoos Forging New Role in Science
NIMH Faces Renewed Uncertainties
Briefing: High Court Upholds EPA's "Bubble" Concept; Supreme Court Orders Pesticide Data Released; Environmentalists Produce National Economic Agenda; Fight Over Ag Research Continues; Tennessee Luring Scientists for High-Tech Development; Comings and Goings
EPA Seeks Unified Approach to Risk

RESEARCH NEWS
The Continuing Tale of a Small Worm
The Other T-Cell Receptor Gene
The Art of Learning from Experience

BOOK REVIEWS
American Science in the Age of Jefferson, reviewed by W. D. Jordan; The Explanation of Organic Diversity, N. Knowlton; Geology of Scotland, J. F. Dewey; Geomorphology of Europe, V. R. Baker; Books Received

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Atmospheric Physics and Earth Observations

Mapping from Space: The Metric Camera Experiment: G. Konecny, M. Reynolds, M. Schroeder .................................................. 167
Atmospheric Spectral Imaging: M. R. Torr and D. G. Torr .................................................. 169
Sample Performance of the Grille Spectrometer: M.-P. Lemaître et al. .................................................. 171
Waves in the OH Emissive Layer: M. Hersé .................................................. 172
Observations of Lyman-α Emissions of Hydrogen and Deuterium: J. L. Bertaux, F. Goutail, G. Kockarts .................................................. 174

Astronomy and Solar Physics

X-ray Gas Scintillation Spectrometer Experiment: R. D. Andresen et al. .................................................. 177
Very-Wide-Field Ultraviolet Sky Survey: G. Courtés et al. .................................................. 179
Solar Irradiance Observations: D. Crommelynck and V. Domingo .................................................. 180
Measurement of the Solar Spectral Irradiance from 200 to 3000 Nanometers: G. Thuillier et al. .................................................. 182
Astronomical Observations with the FAUST Telescope: J. Bisker et al. .................................................. 184

Space Plasma Physics

Electron Flux Intensity Distributions Observed in Response to Particle Beam Emissions: K. Wilhelm, W. Stüdemann, W. Riedler .................................................. 186
Phenomena Induced by Charged Particle Beams: C. Beghin et al. .................................................. 188
Atmospheric Emissions Photometric Imaging Experiment: S. B. Mende, G. R. Swenson, K. S. Clifton .................................................. 191
Isotopic Stack: Measurement of Heavy Cosmic Rays: R. Beaujean et al. .................................................. 193
Space Experiments with Particle Accelerators: T. Ohayashi et al. .................................................. 195

Materials

Marangoni Convection in Space Microgravity Environments: L. G. Napolitano .................................................. 197
Solidification and Ostwald Ripening of Near-Monotectic Zinc-Lead Alloys: A. Kneissl and H. Fischmeister .................................................. 198
Unidirectional Solidification of Cast Iron: T. Luyendijk, H. Nieswaag, W. H. M. Alsem .................................................. 200
Protein Single Crystal Growth Under Microgravity: W. Litske and C. John .................................................. 203

Life Sciences

Spatial Orientation in Weightlessness and Readaptation to Earth’s Gravity: L. R. Young et al. .................................................. 205
Effects of Rectilinear Acceleration and Optokinetik and Caloric Stimulations in Space: R. von Baumgarten et al. .................................................. 208
Vestibulospinal Reflexes as a Function of Microgravity: M. F. Reschke, D. J. Anderson, J. L. Homick .................................................. 212
Prolonged Weightlessness and Humoral Immunity: E. W. Voss, Jr. .................................................. 214
Influence of Spaceflight on Erythrokinetik in Man: C. S. Leach and P. C. Johnson .................................................. 216
Venous Pressure in Man During Weightlessness: K. A. Kirsch et al. .................................................. 218
Mass Discrimination During Prolonged Weightlessness: H. Ross, E. Brodie, A. Benson .................................................. 219
Eye Movements During Sleep in Weightlessness: O. Quadens and H. Green .................................................. 221
Radiobiological Advanced Biostack Experiment: H. Bücker et al. .................................................. 222
Radiation Measurements Aboard Spacelab 1: E. V.enton et al. .................................................. 224
Microorganisms in the Space Environment: G. Horneck et al. .................................................. 226
Cell Sensitivity to Gravity: A. Cogoli, A. Tschope, P. Fuchs-Bislin .................................................. 228
Neurospora Circadian Rhythms in Space: A Reexamination of the Endogenous-Exogenous Question: F. M. Saltman et al. .................................................. 232

CovE

Klyuchevskaya Spoka volcanic complex located on the Kamchatka Peninsula, Union of Soviet Socialist Republics (56°05'N – 160°34'E). This is the tallest (4750 meters) of the Kamchatka volcanoes, one of the world’s most active volcanic areas. The Kamchatka River meanders around the volcanic complex. Photo was taken from Columbia spacecraft during the 24th orbit of the earth, 30 November 1983. [NASA–Lyndon B. Johnson Space Center, Houston, Texas 77058]
Spacecab 1

This issue contains the first scientific reports of results obtained with Spacelab 1 during its flight of 28 November through 8 December 1983. The mission was the first of many in which a complex laboratory designed and built by the European Space Agency will be used. Accordingly, although experiments were conducted, a primary purpose of the mission was to prove out the thousands of structural, mechanical, and electronic parts that make up the laboratory. For example, the Spacelab structure and the laboratory components were monitored during ascent and descent when they were being subjected to maximum accelerations and vibrations. More than 200 sensors situated throughout the Spacelab were used.

The Spacelab consists of two major elements: a pressurized, habitable laboratory called a module in which scientists can work without cumbersome space suits and unpressurized pallets designed to support instruments which require direct exposure to space. The particular module used in Spacelab 1 had a diameter of 4.26 meters and was 7 meters long.

Spacelab was a multidisciplinary mission with five major areas of scientific research represented: astronomy and solar physics, space plasma physics, atmospheric physics and earth observations, materials science, and life sciences. The laboratory contained 38 different experimental facilities. Sixteen were situated on the pallet and 20 in the module; two had components both on the pallet and in the module. Some of the experimental facilities operated automatically, while others were operated from the ground or remotely by the scientific crew through the computer. Other experiments in the module were operated directly by the crew.

The 38 experimental facilities were used to conduct more than 70 investigations. These experiments were selected from more than 400 proposals solicited by NASA and ESA in 1976. An international panel selected the experiments to be conducted on the basis of scientific merit and suitability for flight on the Spacelab-shuttle. A minority of the investigators are located in the United States. In this issue about two-thirds of the reports are authored by European scientists.

Overall the facilities in the Spacelab functioned quite well. There were some problems, but most defects could be corrected or circumvented by the scientific crew. The major disappointment was the delay in the launch of the shuttle Columbia for more than a month.

Communication between Spacelab 1 and ground was excellent. Real-time television images from orbit were available for long periods, permitting close interaction of the scientific crew with principal investigators on the ground. As the mission progressed results poured in, and the new information was used to alter procedures for experimentation later in the mission.

Some investigations produced results immediately. This was especially true of the life science experiments. Other studies involved collection of enormous amounts of data that were stored electronically for complete analysis later. In addition, results are available from only a few of the materials science experiments. The full story awaits detailed study of samples returned from the mission.

Long-term support for Spacelab missions will depend on perceived possibilities of practical applications. The potential that has been most talked of is materials processing. On Earth, when substances crystallize they have a density different from the liquid and hence the crystals move up or down. Under microgravity the crystals remain suspended. The usefulness of this phenomenon was demonstrated in Spacelab 1 when protein crystals with a volume 1000 times those obtainable on Earth were prepared.

Those who go into a laboratory for the first time to conduct an experiment under new conditions are lucky when they have any kind of a result to show for their efforts. The patient and careful planning for Spacelab 1 paid off in the many results reported in this issue. The achievements thus far are a good omen for further successes as the lessons learned to date are used in planning for later Spacelab missions.—PHILIP H. ABELEBON.