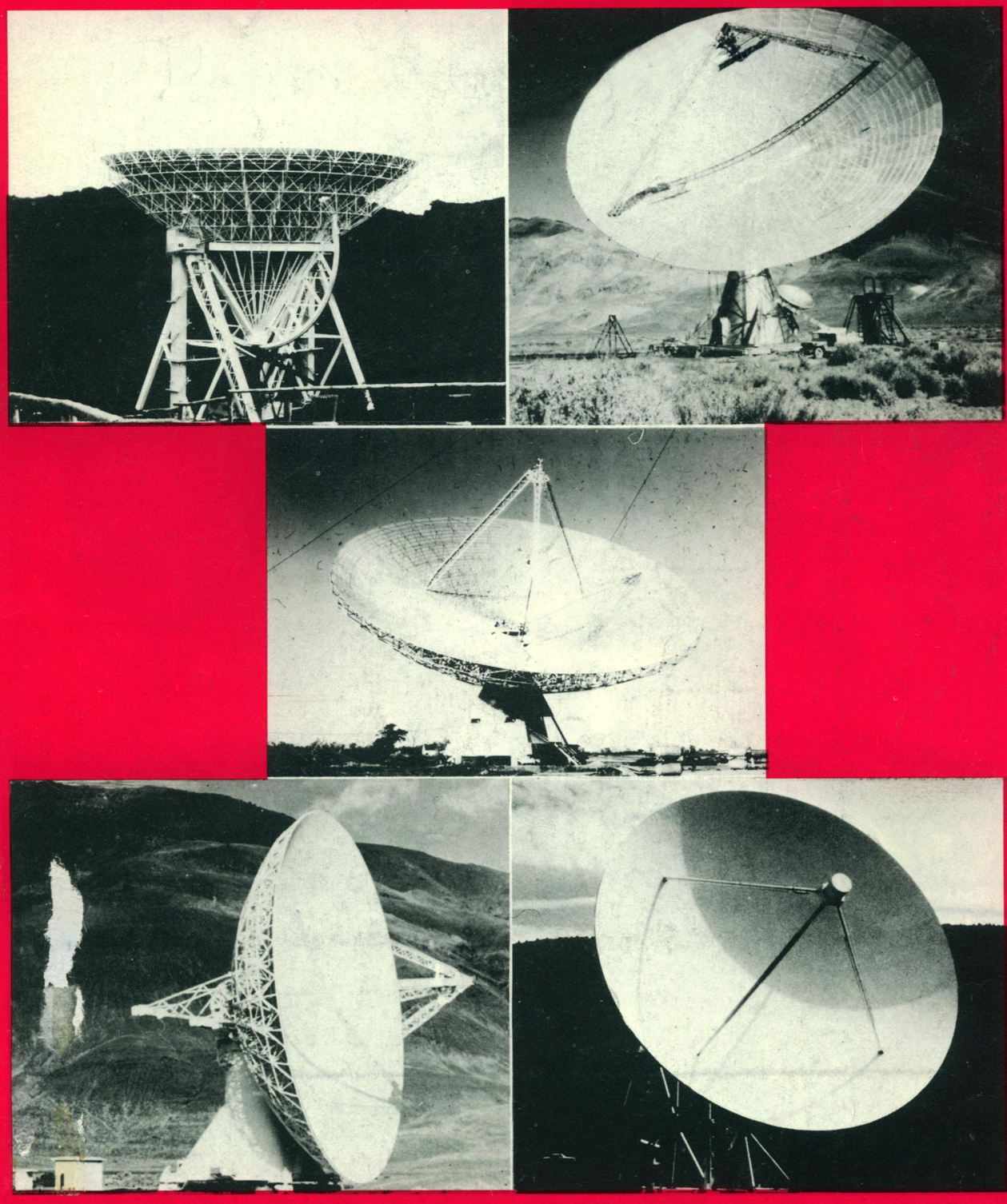
SCIENCE

27 June 1975

Volume 188, No. 4195

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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27 June 1975

Volume 188, No. 4195

SCIENCE

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COVER

(Upper left) Three hundred-meter telescope, Max Planck Institut für Radioastronomie, Bonn, Germany; (upper right) 90-foot telescope, Owens Valley Observatory, California Institute of Technology; (center) 120-foot telescope, Vermillion River Observatory, University of Illinois; (lower left) 130-foot telescope, Owens Valley Observatory, California Institute of Technology; and (lower right) 85-foot telescope, Hat Creek Observatory, University of California, Berkeley. See page 1263. [G. W. Swenson, Jr., University of Illinois at Urbana-Champaign, Urbana]

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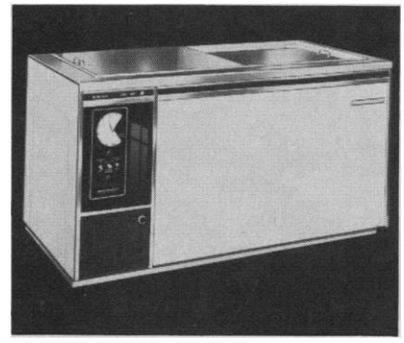

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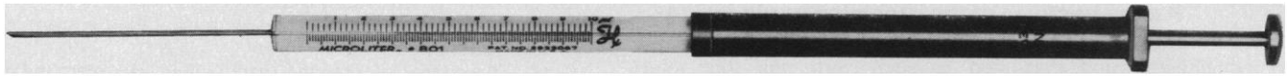
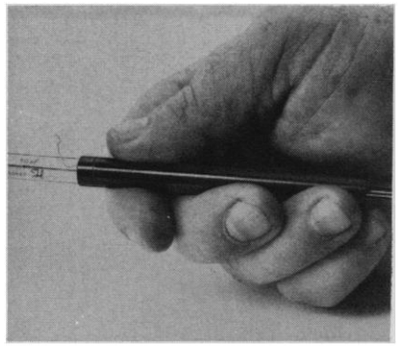
A handle on a syringe comes in handy.



If you've never considered the construction of a syringe, this syringe might look a little awkward. But it's far from it.

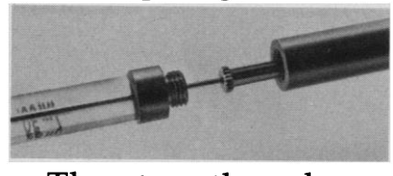


It is really comfortable to hold and convenient to use a syringe with a metal handle. The weight balances nicely in your hand and allows you to hold the syringe without the heat of your body affecting the sample.

The flange in the handle contains a friction ring that gives you an adjustable drag on the stem — plunger, providing resistance against high pressure inlets.

Prevents the bends

Another major attraction of the metal handle is that it practically eliminates plunger bending. A heavy metal stem travels through the handle and acts as a sturdy guide for the smaller plunger.



The stem threads onto the plunger, stabilizing it and helping to prevent the plunger from bending.

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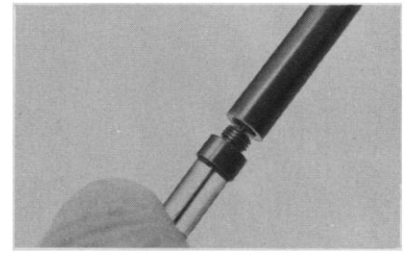
If you damage the glass, needle or plunger, you don't have to throw the whole syringe away. Just replace the syringe assembly.



The glass barrel threads into the metal handle to give you a solid connection. It's easy to make replacements.

The syringe with a handle. It comes in 5 μl and 10 μl capacities, with a fixed needle or a replaceable needle. They're available from authorized dealers. For more information and literature on our 800 Series Syringes, write to John Nadolny, Hamilton Company, Post Office Box 10030, Reno, Nevada 89510.

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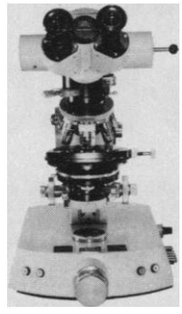

The camera, the controls, and the flash are completely integrated. Everything is built-in for ready accessibility and compactness. And, besides the flash, you still have the widest choice of illumination equipment and other accessories for all microscope techniques in both transmitted and reflected light. Moreover, it accepts photometers, TV, projection screen, and other format cameras.

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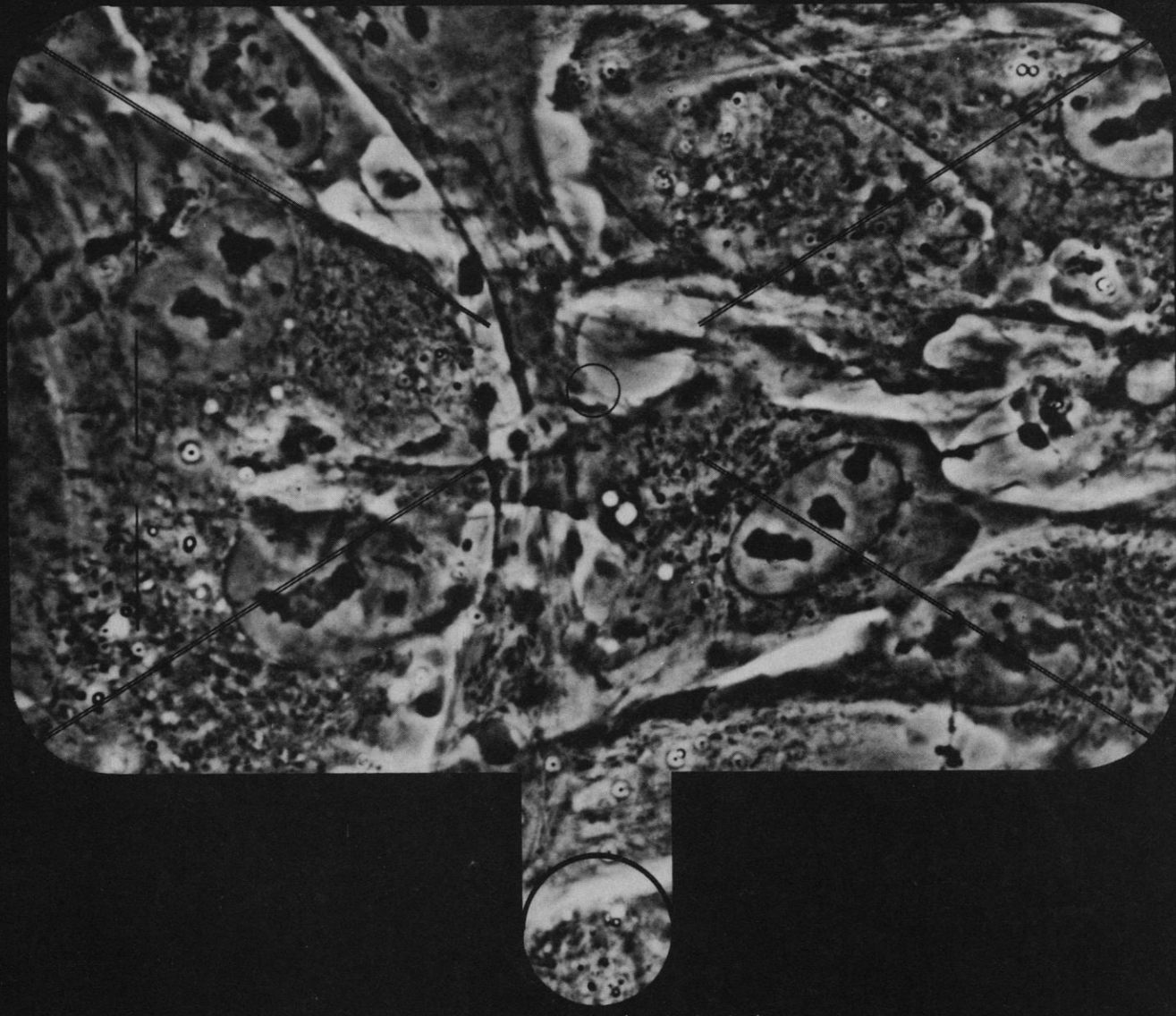

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	GCA/McPherson 707D	Beckman 25	Gilford 250	Varian 635D
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Wavelength Accuracy	±0.1 nm throughout	±0.5 nm throughout	±0.5 nm at 400 nm	±0.5 nm throughout
Absorbance Range (digital display)	−0.3 to +3.000 Abs	0.0 to +2.000 Abs	0.0 to +3.000 Abs	−0.5 to +3.000 Abs
Digitally Programmable	Yes	No	No	No
Signal Averaging or Damping	Digital signal averaging	Damping	Unavailable	Damping
Automatic Sample Positioner Available	Yes	Yes	Yes	Yes
Beam Configuration	Double-beam	Double-beam	Single-beam	Double-beam
Atomic Absorption Available	Yes	No	No	No
Gel Scanner Available	Yes	Yes	Yes	Yes

All information based on manufacturers' recent literature.

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The most valuable accessories, such as the uniquely easy-to-use High Resolution Goniometer and any X-Ray analyzer of your choice, can be added without exchanging specimen stages or lenses. Without re-alignment. Without restricting the microscope in any way for other uses.

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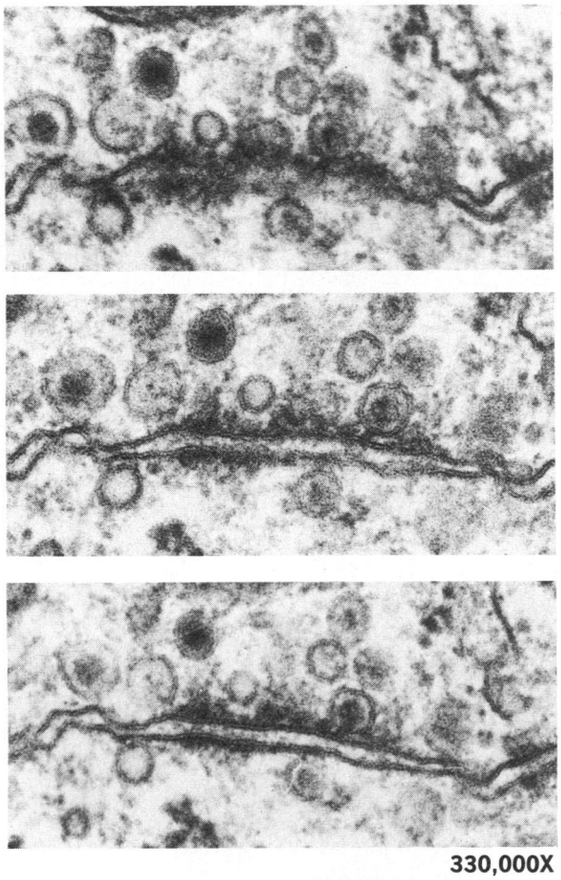
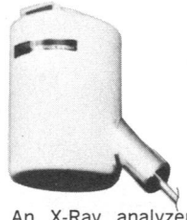


330,000X

Synapse between two glomus cells of the rat carotid body at various angles of tilt. Without tilt the pre- and postsynaptic membranes are indistinct, because the plane of the section is tangential to the plane of the synapse. At −40°, the synapse appears as if cut in cross-section. At + 40° a view of the synapse is obtained nearly orthogonal to that of −40° tilt. Taken with the EM-10 by Dr. Donald McDonald, Cardiovascular Research Institute, University of California, San Francisco.

(Since publication printing cannot show the incredible detail, send for full size glossies.)



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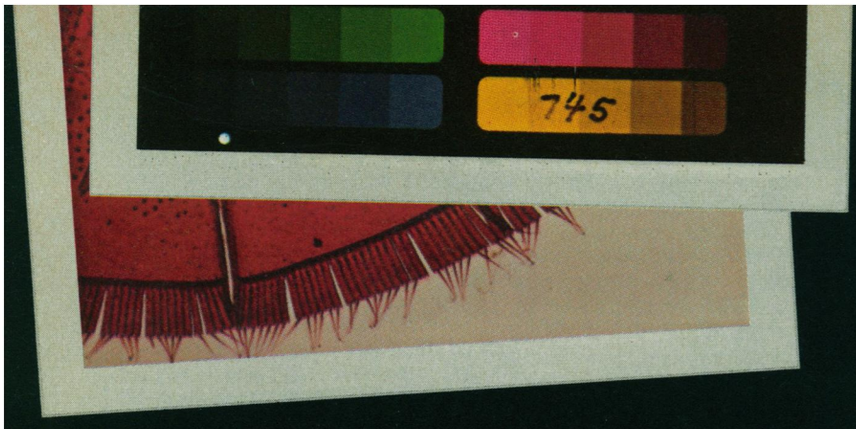

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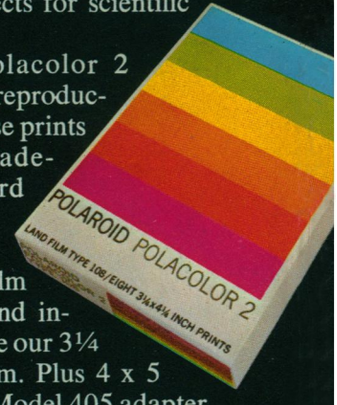

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Polacolor 2

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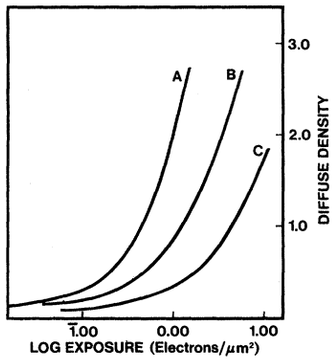
Slower (less sensitive) photographic materials generally have the best resolving power and least grain. In addition, since they require more electrons for proper exposure, random fluctuations in the electron beam have a greater chance to even out. Thus, evenness of exposure is increased, which improves the signal-to-noise ratio.

Besides the emulsion itself, the support material merits attention in TEM work, since exposures are made in a vacuum. Glass plates pump down very fast, as do films on Estar polyester base. Triacetate-base films take longer.

For maximum versatility in exposure and processing, and when glass plates are needed, KODAK Electron Image Plates are a good choice. As the chart shows, processing can be varied to give a considerable range of speed and grain combinations.

For a similar emulsion on a flexible Estar base, specify KODAK Electron Microscope Film 4489.



Exposure/density curves for KODAK Electron Image Plates exposed with 100 kV electrons.
Curve A represents an extended development which produces maximum speed and the most grain. Curve B is an intermediate development, for medium speed and grain; and Curve C is short development, with minimum speed but the least grain.

A film for SEMs.
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And some papers for printing both.
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For instance, KODAK POLYCONTRAST Rapid RC Paper and KODABROME RC Paper are resin-coated papers that can be completely processed in only eight minutes wet time. Drying is fast, too. Or for even more processing speed, KODAK EKTAMATIC SC Paper produces damp-dry stabilized prints, via a countertop processor, in just 15 seconds.

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LETTERS

Law of the Sea Negotiations

The short report on the recent Geneva session of the Law of the Sea Conference by Deborah Shapley (News and Comment, 30 May, p. 918) is deficient in describing the "Informal single negotiating text" on the law of the sea; perhaps the most serious deficiency concerns the articles on scientific research. Shapley's report misses significant elements of the relevant articles and omits mention of other, quite different, articles on the same subject. In total, the draft articles are a disaster because of their potential impact upon the conduct of research at sea, but one would not get this impression from the *Science* report. Scientists should be aware of the unsatisfactory state of these articles, since versions of some of them could well be in the treaty that eventually emerges if nothing is or can be done to change the outcome.

Part I of the negotiating text concerns the seabed and contains what should be considered wholly unacceptable articles on research. These provisions would permit seabed research, such as the Deep Sea Drilling Project, only after the sponsoring entity reaches a contractual arrangement or some other form of association with the International Seabed Authority, which would be created by the treaty. The Authority would not be required to conclude such a contract or association, and in any case the arrangements it makes must permit it to exercise direct and effective control over the research activity. Part III of the text also contains articles on seabed research, and it provides, as Shapley notes, for free conduct of research subject to notification to the Authority, but there is presently no assurance that the Part III text will be adopted.

Shapley's description of the economic zone and continental shelf articles is only partially correct. Research in the economic zone (approximately 35 percent of the ocean if a 200-mile limit is adopted) and on the continental shelf (where the margin extends beyond 200 miles) is dealt with in Parts II and III of the text, and the two parts are not entirely consistent. In Part II, Articles 49 and 71 provide that consent of the coastal state must be obtained to conduct research in the economic zone and on the shelf. This means that a substantial part of current marine research at sea would, in the future, be subject to the discretionary control of the coastal state. The text does add that, under certain conditions, such consent shall not normally be withheld, but this same proviso has proved worthless in the existing shelf treaty, and no one takes it as a serious limitation on coastal state authority in the informal text.

Part III, which is partially described in Shapley's article, does make a distinction between resource-related and fundamental research in the economic zone, requiring coastal consent only for the former. However the distinction between the two types of research is not defined in these articles; this task is left to an unidentified forum at some unspecified future time. In practical effect, the lack of a definition leaves it to the coastal state to decide which research is resource-related, and that decision is not effectively reviewable. In essence, these articles also would establish a consent regime for research.

It seems likely that, unless vigorous action is taken by the scientific community, there will be serious obstacles to scientific research at sea in the future as a result of a Law of the Sea treaty. These obstacles will mainly result from the transfer of control over research from sponsoring groups and states to coastal states. Research certainly will not end as a result, but its pace, magnitude, and location are likely to be affected in undesirable ways because of funding and political decisions attendant upon the shift in control. It is likely, too, that scientists will choose not to conduct research in those areas where major barriers and unpalatable conditions are imposed.

WILLIAM T. BURKE

School of Law,
University of Washington,
Seattle 98195

Mention of the consent requirement of Articles 49 and 71 in Part II of the negotiating text was omitted because the committee that wrote them, Committee II, has no jurisdiction over scientific research. Committee III, whose views are reflected in Part III of the text, has jurisdiction over most scientific research, and Committee I, whose views are reflected in Part I, has some jurisdiction over resource-related research in the high seas and the seabed.

—D.S.

Tetrapod Gait Patterns

In his review of P. P. Gambaryan's *How Mammals Run* (*1*), Matt Cartmill (23 May, p. 844) states that asymmetrical gaits "are of particular importance for two reasons: they are the characteristic high-speed gaits of terrestrial mammals, and they are unique to the class Mammalia." Asymmetrical gaits are divided into two classes by Gambaryan, either ricochets or gallops.

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The simplicity, reliability, and effectiveness of the Sony U-matic Videocassette System are what have made it so successful.

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*Educational & Industrial Television, February 1974
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I would like to point out that crocodilians can gallop (*2*) and, therefore, asymmetrical gaits are not unique to mammals.

This observation should not detract from either Gambaryan's thesis on mammalian locomotion or Cartmill's critique. However, since crocodilians are survivors of a once major archosaurian radiation, this observation bears on the currently popular question of the extent to which archosaurian reptiles, particularly dinosaurs and their descendents, converge on mammals. Bakker (*3*) has amassed data to show that dinosaurs were active, cursorial homeotherms and apparently believes certain quadrupedal forms galloped (*4*). Gambaryan derives bipedal mammals from ancestors with high-speed, asymmetrical gaits. Certain recent reconstructions of ornithischian dinosaurs present generalized forms as fast-moving, highly active bipeds (*5*); the once-accepted image of dinosaurs as slow, lumbering beasts is fast fading. Furthermore, both Bakker and Ostrom (*6*) derive birds directly from saurischian dinosaurs and Ostrom conceives of *Archaeopteryx* as a "very active, fleet-footed, bipedal, cursorial predator." Vestiges of asymmetrical gaits not only occur in crocodilians, but can be seen in modern birds during take-off.

If asymmetrical gaits have been important in the evolution of the Mammalia, they must also have been important in the evolution of the Archosauria.

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"Ecology": A Clarification

It is quite true that the history of ecology is largely unstudied, but R. Goodland (Letters, 25 Apr., p. 313) does not clarify the history of ecology with his assertion that Henry David Thoreau, rather than the zoologist E. H. Haeckel, first used the word "ecology." This misunderstanding was explored some years ago in the pages of *Science*. Walter Harding, a well-known Thoreau scholar, had transcribed (*1*) a handwritten letter from Thoreau to his cousin Henry Thatcher, which is the source of the quotation—including the word "ecology"—to which Goodland alludes. P. H. Oehser (*2*) followed Harding in ascribing the word "ecology" to Thoreau. Subsequently, Harding reviewed his transcription of the Thoreau letter and stated (*3*) that the word he had earlier read as "ecology" was actually "geology."

The science of ecology had very diffuse origins in botany, zoology, oceanography, limnology, and various aspects of natural history and applied biology, and it is impossible to attribute its founding to one individual. Ecologists do not generally assert that Haeckel was the founder of ecology. There is, however, general agreement that he coined the term "oecology," recognizing it as a logical subdivision of biology, that he provided a reasonably usable definition, and that he first used the word in 1866 or 1869.

It is clearly the case, as Goodland states, that ecology as a formal, named aspect of biological science owes much to J. E. B. Warming and also to other European botanists: O. Drude and A. F. W. Schimper published extensive studies on "Oecology" in the 1890's and stimulated interest in ecology in the United States, especially on the part of C. E. Bessey and J. M. Coulter and their respective students F. E. Clements and H. C. Cowles. The pages of *Science* (*4*) provide a detailed exchange of letters concerning the origin, etymology, meaning, and proper spelling of oecology or ecology.

Depriving Henry Thoreau of whatever honor there may be in being the earliest user or coiner of the word ecology does not deprive him of the very proper recognition of his role as a pioneer ecologist (probably before the word existed) who clearly recognized the ecological concept of succession (*5*) and who is commonly described as the father of phenology (*6*), an important facet of ecology dealing with the chronology of natural events.

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27 June 1975, Volume 188, Number 4195 **SCIENCE**

Solar Power in the Middle East

The richest Middle Eastern oil state is seriously considering a major program of solar development. There is talk of Saudi Arabia becoming the world's first "solar economy" and of "using solar power to make the desert bloom."

The motivations behind a major Arabian solar effort would be diverse. The Saudis are acutely aware that their petroleum stocks are finite. They genuinely lament the explosive projected demand for oil as fuel and would welcome an alternative energy source which could serve to stretch their oil supply over a longer period. Global leadership in solar research could lead to continued Saudi importance in global energy affairs.

There also seems to be a genuine Arab desire to help their Third World sister-states. The Saudis committed about 13 percent of their 1974 gross national product to foreign aid (compared to 0.25 percent for the United States). Many of the world's poorer countries lie in geographical areas of high solar flux. If a major Arab solar effort is embarked on, if progress is made in reducing the dollar cost and initial energy investment in manufacturing solar devices, and if this technology spreads around the equatorial band, the future geographic distribution of global economic activity could be significantly influenced.

Most of the current energy demand in nonindustrialized countries is for low-grade heat. At present this energy is typically released from the combustion of firewood and animal dung—both of which are in short supply. Indeed, the "firewood crisis" exacts its toll from more of mankind than does the oil crisis.

Mass production of inexpensive solar stoves could substantially reduce the demand for firewood. Solar hot air systems, useful for such purposes as space heating or crop drying, are being adapted to local conditions in many countries. Solar water heaters are already common in Israel, Cyprus, India, and Japan.

Solar water pumps have been available in the desert regions of the world for decades, albeit at high prices. Frank Shuman built a 55-horsepower solar irrigation pump near Cairo, Egypt, in 1913. Today the governments of Niger, Mauritania, Senegal, and Upper Volta are operating solar pumps, in hopes that this technology may eventually help stem desert encroachment.

Such inexpensive, elementary solar technologies could play an important role in the Third World. What has not been so well recognized, however, is that the development of sophisticated solar technologies capable of providing economic high-grade energy may have far-reaching implications for development patterns. Much of the global South has a greater solar potential than the industrial North. The ground-level solar flux in Saudi Arabia is roughly twice as high as in the contiguous United States.

Progress has been slow in the development of competitive solar devices to provide high-grade energy. But this situation is changing rapidly. Proposals for mass-produced photovoltaic cells, solar thermal electric farms, bioconversion plantations, and wind power generators are no longer dismissed lightly.

Funding continues to be the central problem. Solar research has multiplied fivefold in the United States over the past 2 years, but solar technology remains among the lowest-priority items in the nation's energy budget. This fiscal year's federal outlay for fission nuclear research will be $678 million; for fusion it will be $147 million; for fossil fuel research it will be $253 million; and for solar it will be $25 million, up from $9 million last year. (Next year's U.S. solar budget should be larger, reflecting the field's new political credibility.)

Technical research has tended to be limited to the highly developed nations, all of which are in the temperate zones. The recent spread of vast oil revenues to otherwise poor desert countries may change this pattern. Several Middle Eastern states have been contracting with American and European institutions to develop new research "centers of excellence" in that region. This development can be expected to lead to an increased research emphasis on topics of equatorial concern. There could be no clearer indication of such a shift than the funding of a major solar effort, designed to meet the needs of the global South as well as the North.—DENIS HAYES, *The Worldwatch Institute, 1776 Massachusetts Avenue, NW, Washington, D.C. 20036*

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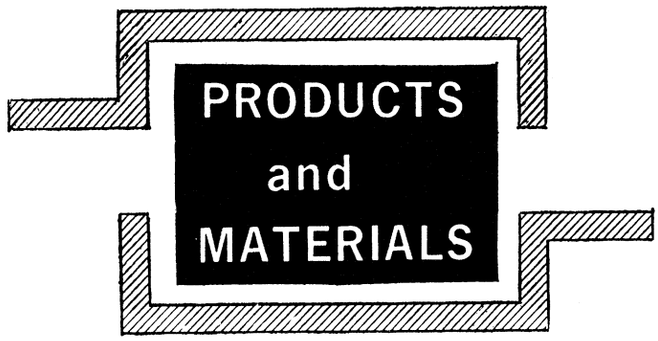

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Miniature Portable Pyrometers

The models of the MMP series are thermocouple pyrometers with 2.5-inch scales calibrated in Fahrenheit and Celsius. They are available in five calibrations covering from −200° to +2500°F in nine ranges. They are self-actuated by thermocouple sensors and require no other power. Meters are self-compensated for ambient temperature. Nanmac Corporation. Circle 795.

Newly offered instrumentation, apparatus, and laboratory materials of interest to researchers in all disciplines in academic, industrial, and government organizations are featured in this space. Emphasis is given to purpose, chief characteristics, and availability of products and materials. Endorsement by *Science* or AAAS is not implied. Additional information may be obtained from the manufacturers or suppliers named by circling the appropriate number on the Readers' Service Card (on pages 1258A and 1318A) and placing it in the mailbox. Postage is free.—RICHARD G. SOMMER

Radial Immunodiffusion Plate Viewer

The calibrating viewer presents a magnified image of a plate and a projected cursor line automatically determines a true diameter. Diameter is displayed in tenths of a millimeter. The system is parallax-free and variable dark-field illumination reveals even faint rings. The device is arranged for bench-top use and left- or right-handed orientation. Transidyne General Corporation. Circle 793.

Radiometer

The IL440 is used to measure ultraviolet irradiance on photoresist-coated substances used in semiconductor production and photocurable materials. It features direct readout, a stabilized filter detector probe, and interchange of probes without recalibration. The unit operates on internal batteries and includes an indicator light to reveal battery status. International Light Incorporated. Circle 791.

Dissolved Oxygen Meter

Model 1010 has a dual probe for dissolved oxygen and temperature measurement. The device covers the range of 1 to 15 milligrams of oxygen per liter from −5 to +50°C within ±1 percent. A cable windup plate detaches to facilitate the flushing of the probe between uses. Portable device also features a battery check mode. Delta Scientific Corporation. Circle 792.

Liquid Chromatograph

The model 244 offers reproducible flow rates from 0.1 to 9.9 milliliters per minute and sensitive dual detectors. It is designed for pressures up to 6000 pounds per square inch. The detectors are an optical deflection differential refractometer and an ultraviolet-visible absorbance unit. Sensitivity is 0.005 absorbance unit full scale and noise is ±1 percent at 0.005 absorbance unit full scale. The solvent delivery system allows the user to select from three solvent intakes. Waters Associates. Circle 790.

FORTRAN/RT-11 Software

Software support for PDP-11 laboratory and for the RT-11 disk operating system is of use to scientists, engineers, and graphics specialists. The software packages specifically support analog-to-digital data conversion, digital input-output, and graphics systems and relate to peripheral devices and interfaces. Applications include statistical data reduction, programmed calculations, and the monitoring of laboratory instruments. Digital Equipment Corporation. Circle 796.

Freezer

Model ADS-100 is suited to medical research, biological storage and preservation of tissue, plasma, blood cells, microorganisms, and other items. The cabinet is steel and the lid is counterbalanced. An indicator-controller allows temperature adjustment from −100° to +70°F. The cabinet has an air-cooled condenser and requires no liquid coolant. The inner chamber is 26 by 21 by 41 inches high. So-Low Environmental Equipment Company. Circle 798.

Literature

Immunodiagnostic and Research Catalog includes detailed product specifications, applications, and a wall chart devoted to human protein data and comprehensive normal ranges by age, sex, and race. Meloy Laboratories, Incorporated. Circle 787.

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Miran 1 System describes a set of infrared analyzers and accessories including a variety of sampling systems. Wilks Scientific Corporation. Circle 800.

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(Continued from page 1296)

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