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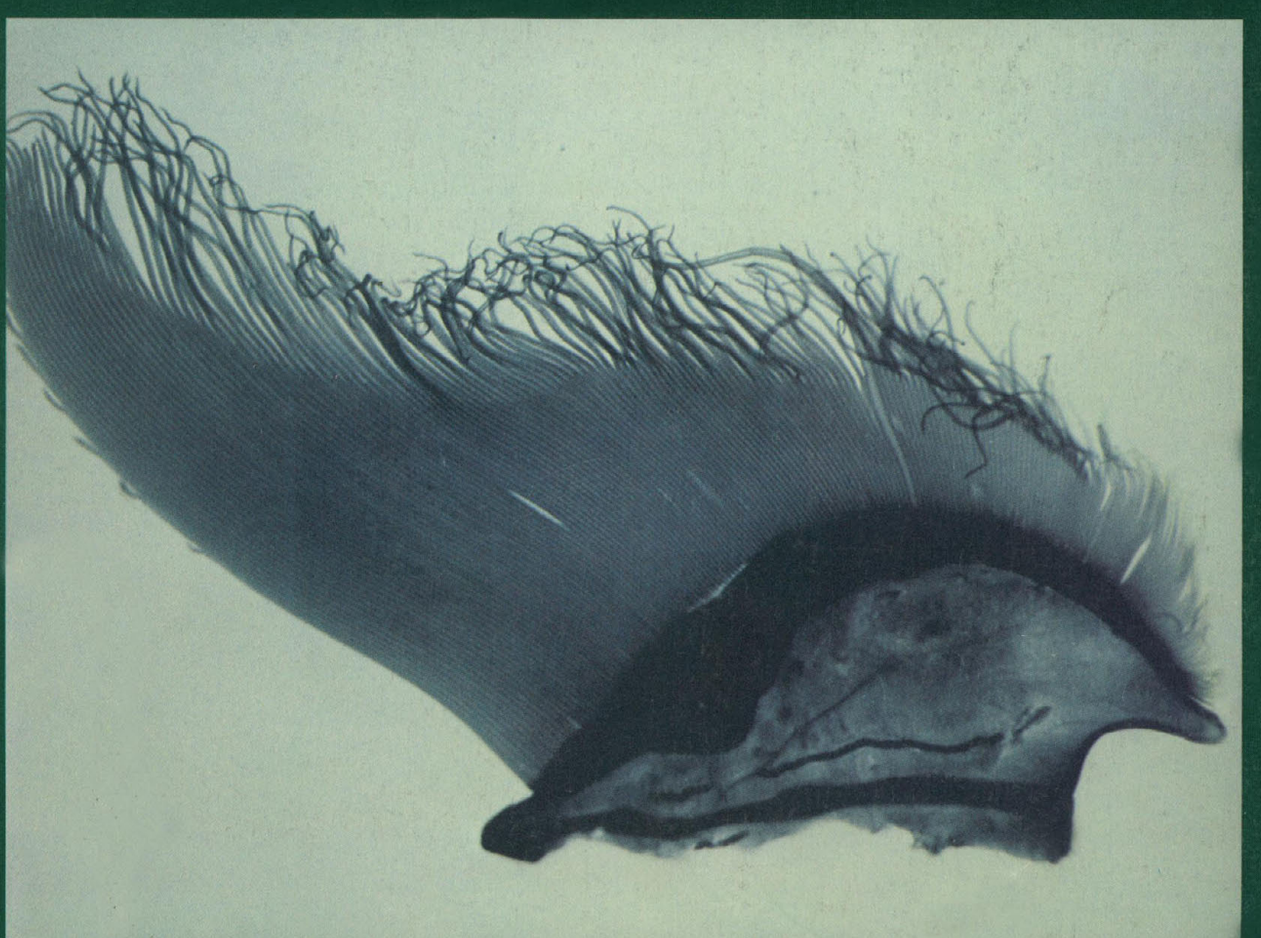

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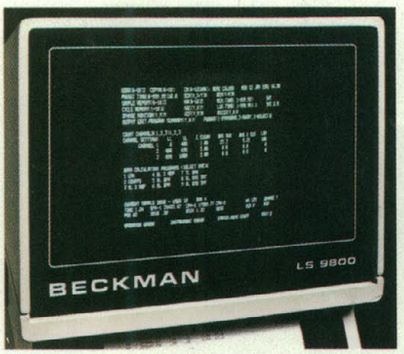

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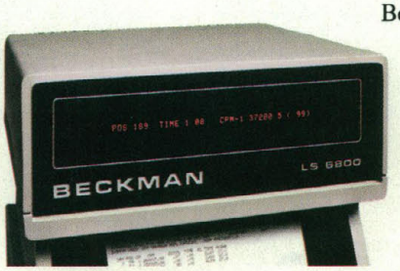

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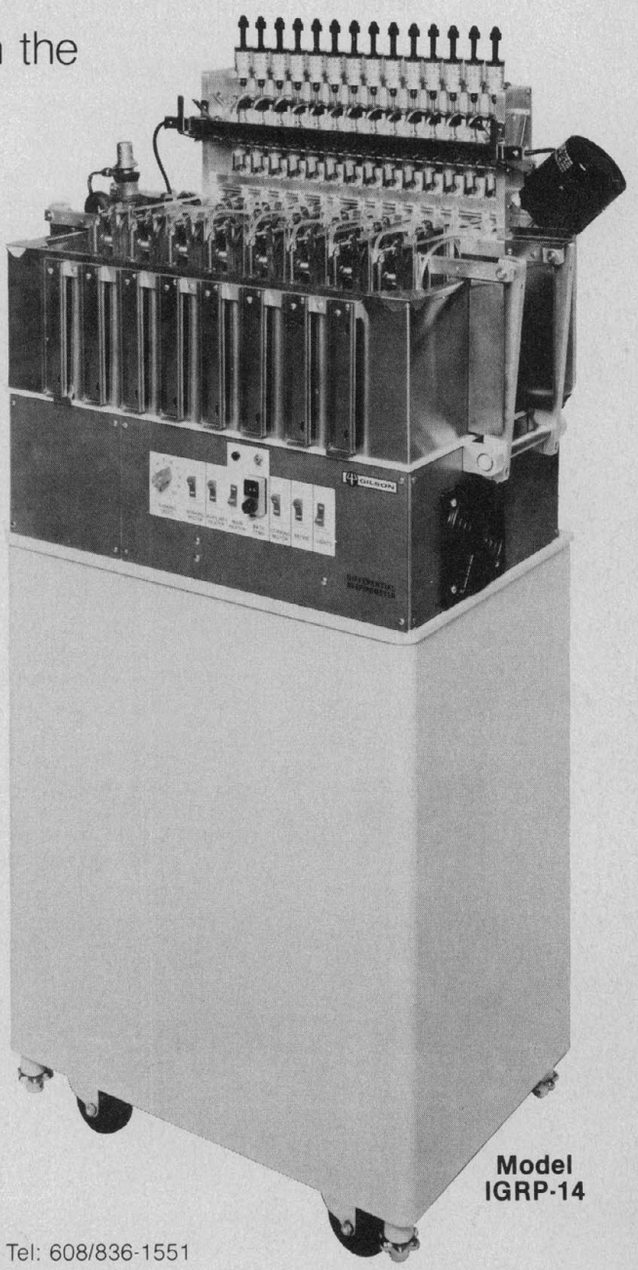

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COVER

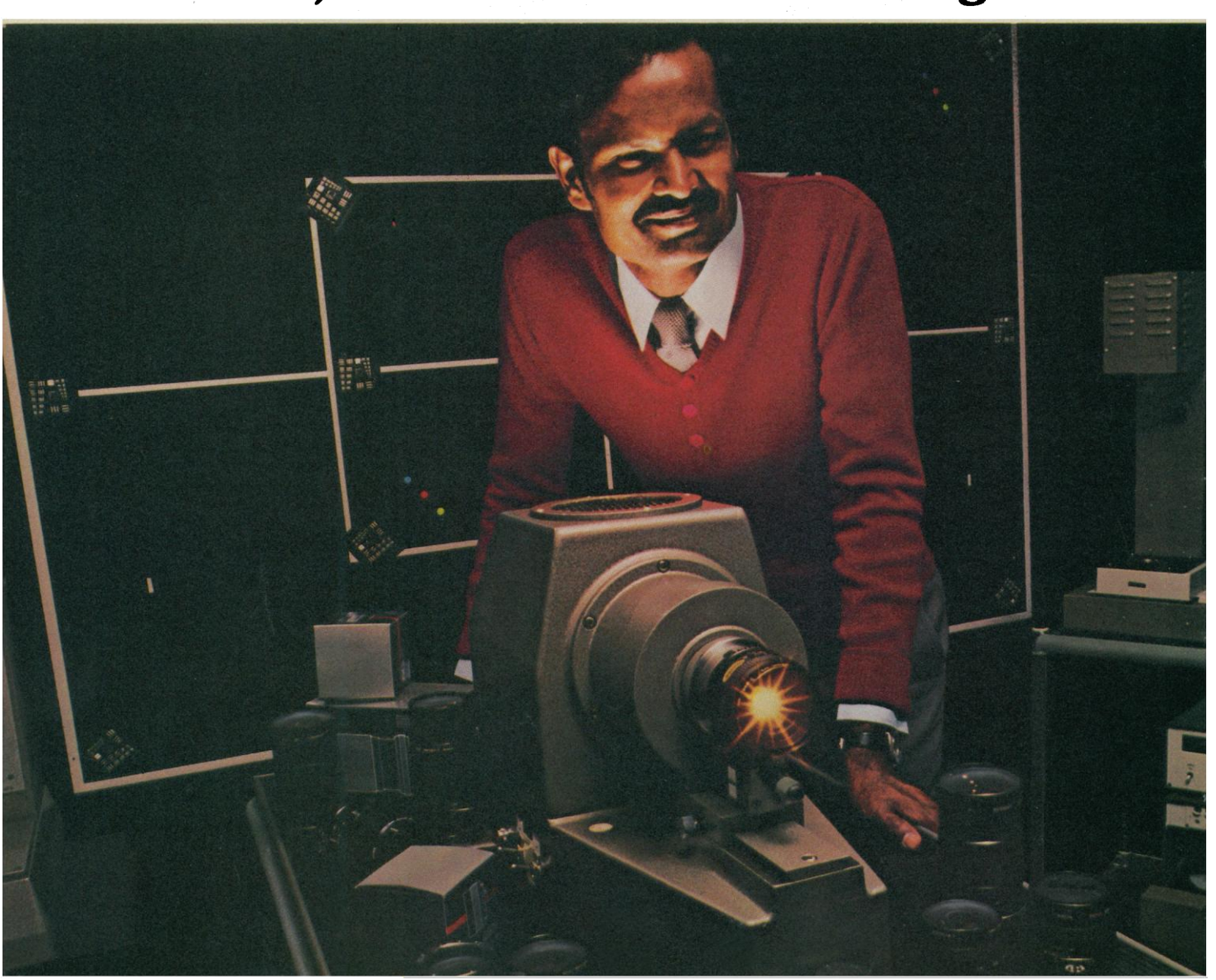
Isolated tentacular lamella, including half of central axial support, of *Riftia pachyptila* Jones (dorsal to right). Each tentacle contains paired blood vessels with connecting intraepidermal capillary loops throughout their length. Up to 335 pairs of lamellae comprise the plume that protrudes from the vestimentiferan worm's tube and forms an efficient exchange organ (Mallory's Triple Stain; × 8.6). See page 333. [M. L. Jones, National Museum of Natural History, Smithsonian Institution, Washington, D.C.]

Reddy Chirra improves his vision with an Apple.

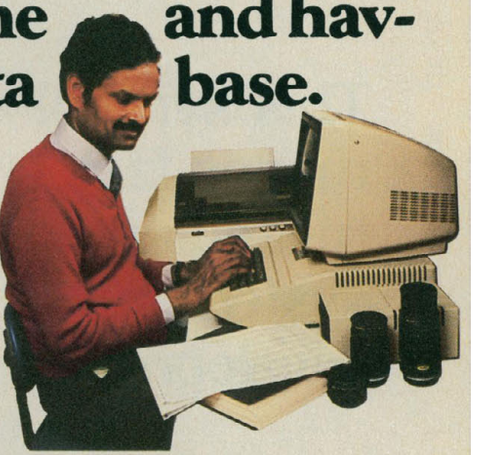
Reddy is an optical engineer who's used to working for big companies and using big mainframes.

But when he started his own consulting business, he soon learned how costly mainframe time can be. So he bought himself a 48K Apple II Personal Computer.

And, like thousands of other engineers



and scientists, quickly learned the pleasures of cutting down on shared time and having his own tamper-proof data base.



His Apple can handle formulas with up to 80 variables and test parameters on 250 different optical glasses.

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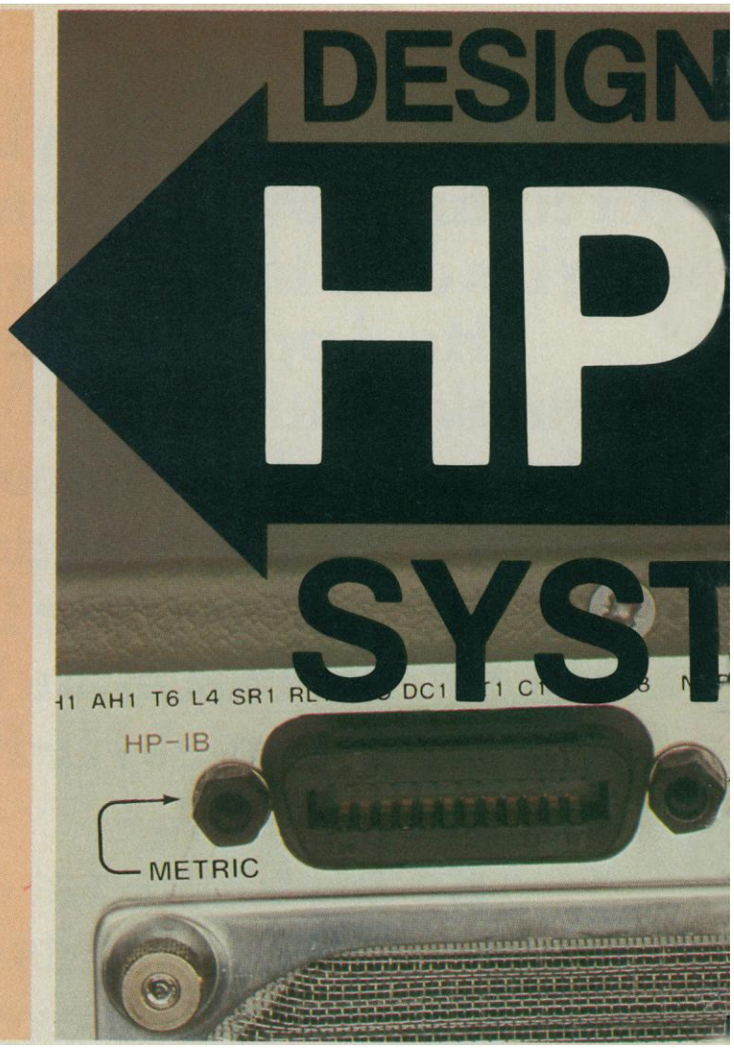

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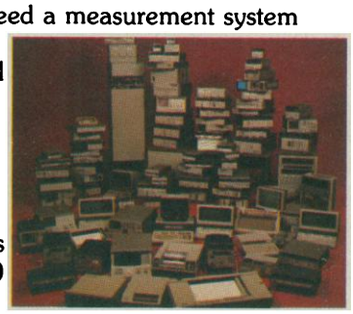

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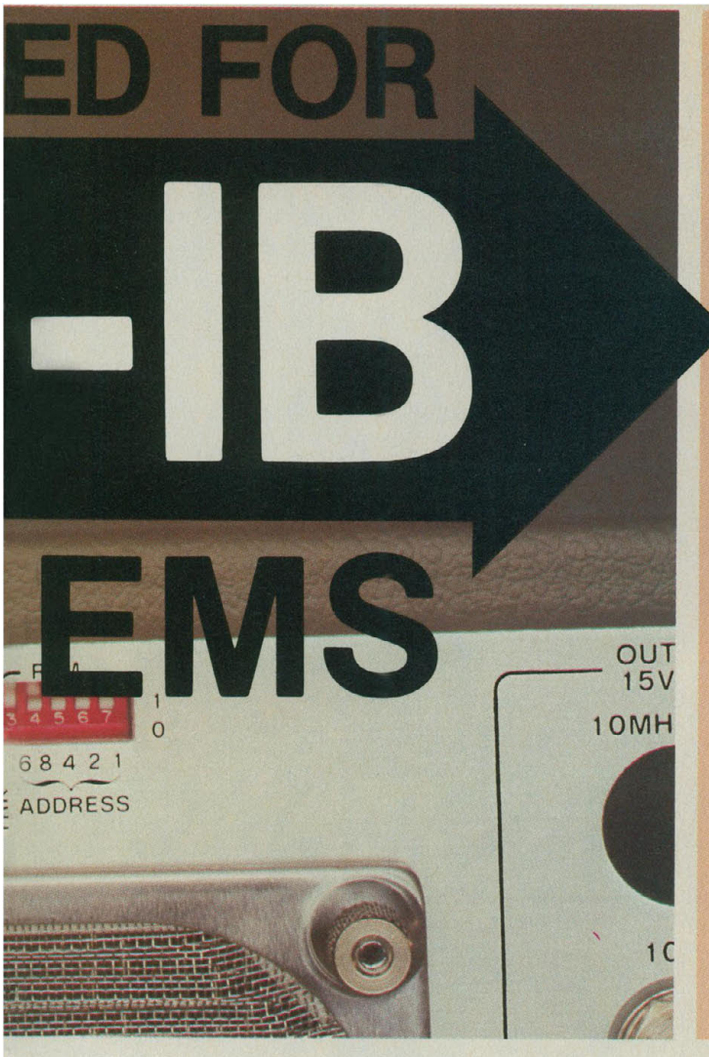

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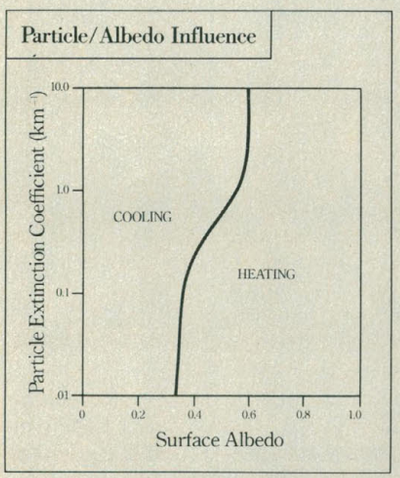
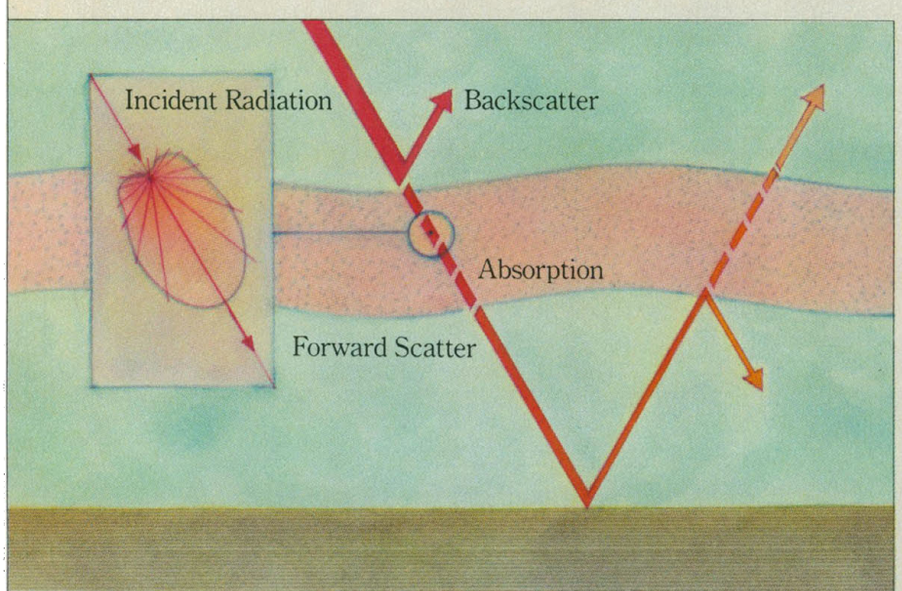
The Albedo Effect

The Albedo Effect

Mathematical models of the atmosphere are the chief scientific tools for predicting long-term climate and identifying possible climatic changes that may result from man's activities. Recent advances at the General Motors Research Laboratories have revealed new information about the contribution of airborne particles to the delicate thermal balance of the earth's atmosphere.



Regions of heating and cooling determined by particle characteristics and surface albedo.



Radiation scattering exhibited by a layer of particles. The inset shows the distribution of scattering by a single particle of mean size.

DEVOID of its atmosphere, the bare earth would reach an average temperature of only −1°C. Atmospheric interaction with solar and terrestrial radiation raises the average surface temperature to fifteen degrees Celsius, making life as we know it possible. Small fluctuations in overall temperature can have large-scale effects. It is believed that a drop of a few degrees Celsius lasting for a period as short as four years could trigger an ice age. Fundamental studies conducted at the General Motors Research Laboratories explore the effect of various atmospheric factors, natural and man-made, on the earth's thermal balance.

New knowledge of the influence of airborne particles on the earth's thermal balance has been revealed by investigations carried out by Dr. Ruth Reck. Dr. Reck's work at General Motors integrated for the first time the complex factor of particles into radiative-convective atmospheric models. Her findings help determine under what conditions particles have a cooling influence, and under what conditions they have a heating influence.

Airborne particles have many sources: volcanic issue, wind-raised dust and sea salt, ash, soot, direct and indirect products of combustion and industrial processing, the products of the decay of plant and animal life, the liquid droplets and ice crystals that make up clouds. Particles alter the radiation flow in the atmosphere by the processes of scattering and absorption. Particles differ by size and composition, factors which determine optical properties.

Prior to Dr. Reck's work, models for calculating the vertical temperature profile included layers of clouds and the significant gases—O_2, O_3, H_2O and CO_2—but neglected the particle factor. To establish the thermal effect of particles, later models assumed a uniform vertical temperature change.

Dr. Reck's contribution was to add the particle factor to a one-dimensional model developed at the Geophysical Fluid Dynamics Laboratory at Princeton University. This model divides the atmosphere into nine layers. An initial temperature distribution is assumed, and the model is used to compute the net radiative energy

flow into or out of each layer. A particle population is input for each layer. Calculated radiation imbalances result in a temperature change for each layer within the model, subject to the condition that change in temperature with altitude not exceed the adiabatic lapse rate. The new temperatures are used to compute a new radiation balance. This process is repeated until there are no further changes in temperature.

The particles of interest, known as Mie-scattering aerosols, are comparable in size to the wavelength of the incident radiation. Dr. Reck models the interaction of these particles with the radiation field in terms of two parameters: the single scattering albedo of the particle, which describes backscatter, and an anisotropic scattering factor, which measures the degree of forward scatter. From these two quantities and the size distribution and abundance of the particles, the transmission, absorption and backscatter of each layer in the model can be calculated.

DR. RECK discovered that whether particles have a heating or cooling influence depends upon the surface albedo, or reflective power, of the earth directly beneath them. Snow (0.6) is more reflective than sand (0.3); water is less reflective than either (0.07). Her results indicate that when surface albedo is small, the net effect of particles is to "shield" the earth from incoming solar radiation, producing a cooling influence. When surface albedo is large, a trapping effect prevails, in which the portion of solar radiation that reaches the earth's surface is "trapped" between the surface and the particles, producing a net heating influence. The competition between these two effects, shielding and trapping, determines the overall thermal influence of particles.

Dr. Reck calculated that for the latitudes between the equator and 35°N, where average surface albedo is low, the current background level of atmospheric particles decreases solar radiation reaching the earth by ~1%, thus producing a net cooling effect. Her findings indicate that heating takes place at latitudes north of 55°N, where average surface albedo is high. Calculations with the model indicate a correlation between the increase in particle abundance due to volcanic activity in 1970 and a subsequent ice build-up in 1971.

"Previous models did not adequately take into account the role played by particles in the earth's thermal balance," says Dr. Reck. "The geosystem is continually changing. It is important for us to understand the elements that affect this evolution, so that we may know how man's activities influence the atmosphere."

THE WOMAN BEHIND THE WORK

Dr. Ruth Reck is a Staff Research Scientist in the Physics Department at the General Motors Research Laboratories.

Dr. Reck received her Ph.D in physical chemistry from the University of Minnesota. Her thesis, on the statistical mechanics of heterogeneous systems, concerned the theory of diffusion-controlled chemical reactions. Prior to joining General Motors in 1965, she was a Research Associate in the Applied Mathematics Department of Brown University.

In addition to global climate studies, Dr. Reck has done research at General Motors in solid state physics and magnetic materials. Over the last seven years, she has participated in several international exchange programs on climate-related subjects.

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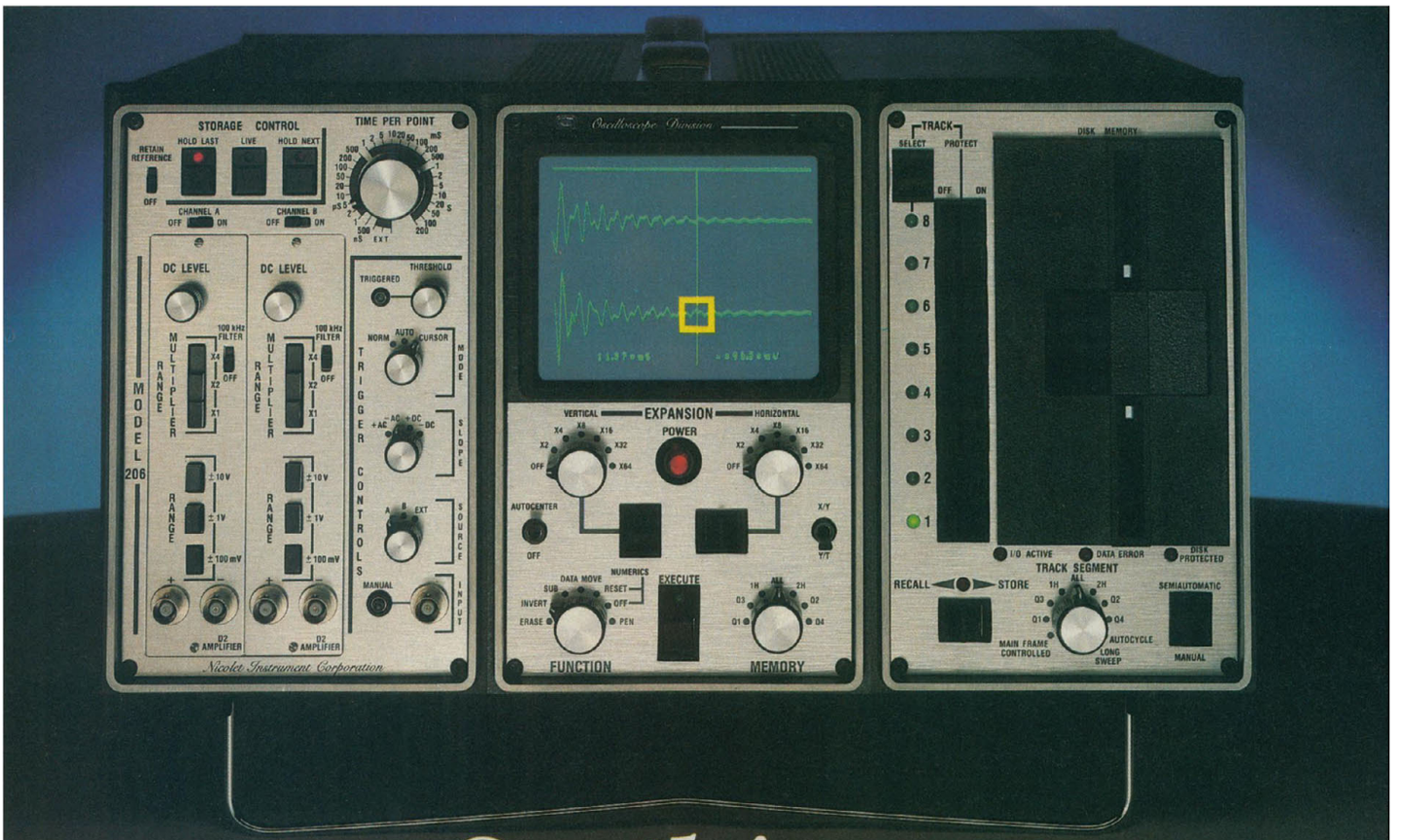

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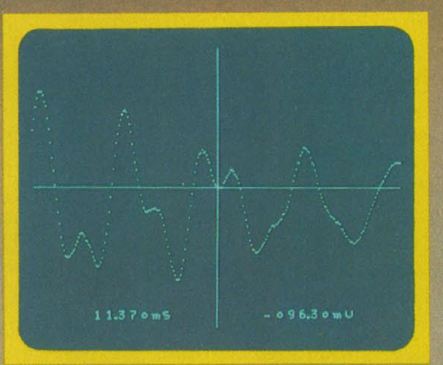

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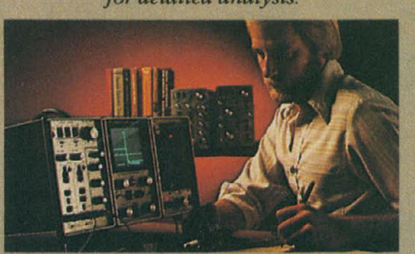

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From DNA to RNA and beyond

These nine systems represent a major achievement in support of DNA/RNA research. They offer pretested, quality-assured sets of matched ingredients for analyzing genes and the products of their expression.

You could of course assemble the ingredients yourself, but here's what you'd likely be missing: Reliability, reproducibility, and hours of time better spent doing the research.

Call to discuss any questions you may have for our technical staff.

Nick Translation

Two exclusive systems for making consistently high specific activity probes using nick translation: dCTP, [^{32}P]- and dTTP, [^{3}H]-. Both systems include *E. coli* DNA Polymerase I prepared in our laboratories to ensure reproducibility. The DNase I, dNTP mixtures, stop buffer, and sterile deionized water are optimized for compatibility and stability.

Systems sufficient for either 20 or 10 reactions contain the following:

- dCTP, [α-^{32}P]-, or
- dTTP, [methyl, 1', 2',-^{3}H]-
- DNase I
- DNA Polymerase I
- Control Plasmid DNA (pBR322)
- Deoxynucleoside Triphosphate Mixture
- Nick Translation Buffer
- Nick Translation Stop Buffer
- Deionized Water

Each lot of systems is tested with the control supercoil pBR322 plasmid DNA to ensure efficient incorporation of dCMP or dTMP into DNA, and a copy of the curve is included with your system.

Ordering information:

- NEK -004 (dCTP, [α-^{32}P]) (20 reactions, tracer in ethanol)
- NEK-004A (10 reactions, tracer in ethanol)
- NEK-004B (20 reactions, tracer concentrated in aqueous solution)
- NEK-004C (10 reactions, tracer concentrated in aqueous solution)
- NEK-005 (dTTP, [^{3}H]) (20-reaction system)

3' End Labeling

The system labels protruding (*Hae* II), flush (*Alu* I), and recessed (*Hin*f I) 3' termini generated from pBR322 with 3'-dATP, [α-^{32}P]- (cordycepin 5'-triphosphate) in a simplified protocol similar to the procedures of Tu and Cohen.[1] The system utilizes terminal transferase to add a single 3'-dAMP, [α-^{32}P]-molecule to the 3' end of a DNA chain. The resulting labeled DNA is suitable for sequencing by the Maxam and Gilbert[2] technique used in our new DNA Sequencing System (see next page).

The components include:

- 3'-dATP, [α-^{32}P]- (cordycepin 5'-triphosphate)
- Terminal Deoxynucleotidyl Transferase
- Terminal Transferase Reaction Buffer
- Cobalt Chloride
- Control Plasmid DNA Fragments
- Deionized Water

Prior to shipment, all system components are subjected to a complete 3' end labeling procedure. The polyacrylamide gel used to separate the fragments is autoradiographed to assess labeling efficiency, and a copy of the autoradiogram is included with your system.

Ordering information:

- NEK-009 (10-reaction system)
- NEK-009A (5-reaction system)

[1]Tu, C.-P.D. and Cohen, S.N., *Gene*, **10:** 177, 1980

5' End Labeling

Adapted from procedures described by Maxam and Gilbert,[2] an efficient, time-saving means of labeling nucleic acid fragments preparatory to DNA sequencing (see next column). The system includes ATP, [γ-^{32}P]- with polynucleotide kinase prepared in our own laboratories, and a carefully balanced complement of buffers, enzymes, and other reagents necessary for labeling the 5' termini of DNA fragments.

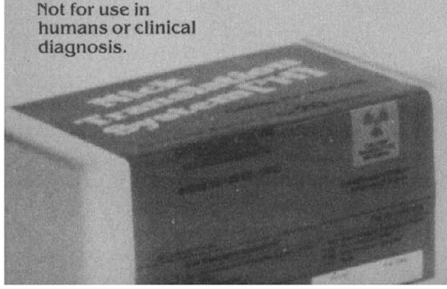
Systems sufficient for either 10 or 5 reactions contain the following:

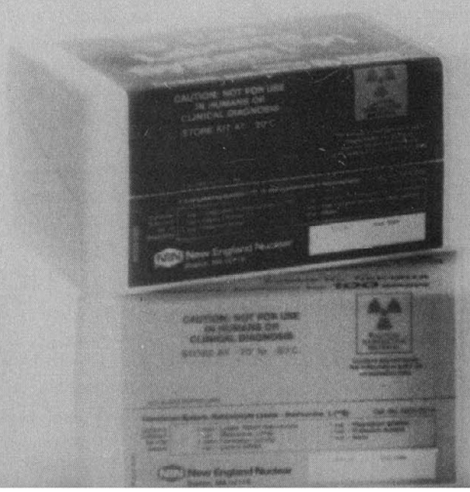
- ATP, [γ-^{32}P]-
- Alkaline Phosphatase
- Polynucleotide Kinase (purified to homogeneity)
- Phosphatase Buffer
- Direct Phosphorylation Buffer
- Exchange Phosphorylation Buffer
- *Hin*f I Digest of Plasmid DNA, pBR322 (control to check system)
- Deionized Water

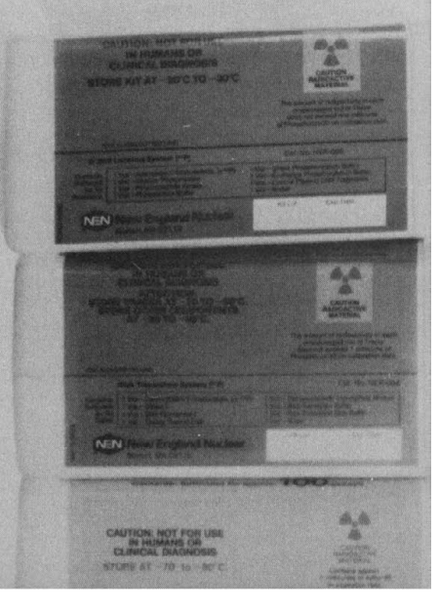
The system is tested the day before shipment using the same lots of components you will receive, including fresh tracer. The resulting autoradiogram is included with your system.

Ordering information:

- NEK-006 (10-reaction system)
- NEK-006A (5 reaction system)







NEW

DNA Sequencing

This system follows the Maxam-Gilbert procedure as published in *Methods in Enzymology* and includes the entire text of the article.[2] It is suitable for sequencing DNA labeled with our 3′ or 5′ End Labeling Systems and includes all reagents necessary for the four base specific cleavage reactions. Sufficient material is provided for at least fifty of each reaction.

The following components are included:

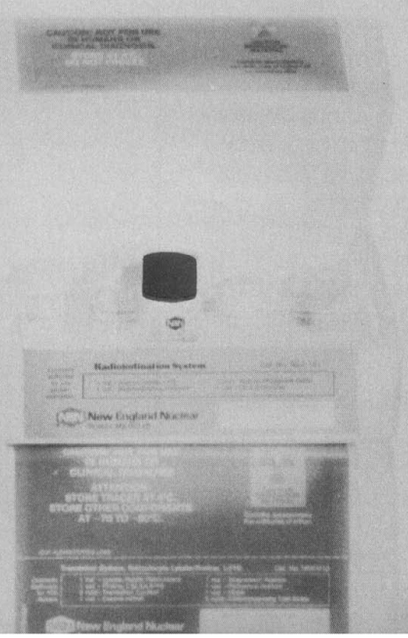
- Dimethyl Sulfate
- Hydrazine
- Piperidine
- Piperidine Formate
- Ferric Chloride
- Sodium Hydroxide
- Maxam-Gilbert Procedure Manual

Each new lot of components is tested before shipment in a sequence analysis of a DNA fragment. The purity of each component is monitored using chromatographic analysis and documented for inclusion with the system.

Ordering information:

NEK-010

[2]Maxam, A.M. and Gilbert, W., *Methods in Enzymology*, **65** (1980)



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Transcription

This system provides all the components necessary to perform eukaryotic cell-free transcription. It contains a cell-free extract derived from HeLa cells which catalyzes the synthesis of mRNA precursors when provided with an exogenous DNA containing a promoter for recognition by the polymerase. This RNA polymerase II dependent reaction is highly sensitive to the presence of α-amanitin. The whole cell extract is prepared as described by Manley and coworkers.[3]

The system also includes UTP, [α-^{32}P]- for labeling specific mRNA precursors. A control DNA template, the cloned *Bal* I-E restriction fragment of Adenovirus-2, has been used to optimize the system and is included with it. This control should be used by the investigator to determine proper functioning of the system.

Components sufficient for performing 50 assays (25μl reaction volume) are listed below:

- UTP, [α-^{32}P]-
- HeLa Cell Extract
- Control DNA Template
- Transcription Cocktail
- Deionized Water

Ordering information:

NEK-014 (50-reaction system)

[3]Manley, J.L., Fire, A., Cano, A., Sharp, P.A., and Gefter, M.L., *PNAS* (U.S.A.), **77:** 3855 (1980)

Translation

Now Proline [^{3}H]

NEN's *in vitro* protein translation systems have made cell-free translations of eukaryotic mRNAs exceptionally reliable and reproducible. These systems are offered with either Methionine, L-[^{35}S]- or Leucine, L-[^{3}H]- or Proline, L-[^{3}H]- labeled tracers. All three utilize an extract of rabbit reticulocyte lysate that has been treated with micrococcal nuclease to remove endogenous mRNA. The lysate is prepared under strictly controlled conditions to ensure retention of high protein synthesis activity.

The components include:

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- Proline, L-[2,3,4,5-^{3}H]-
- Translation Cocktail
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Each lot of systems is biologically tested with the control mRNA. A graph demonstrating Methionine, Leucine, or Proline incorporation is provided with your shipment.

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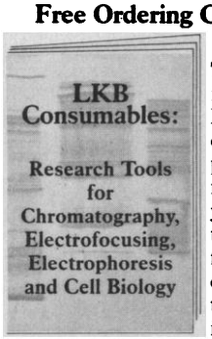

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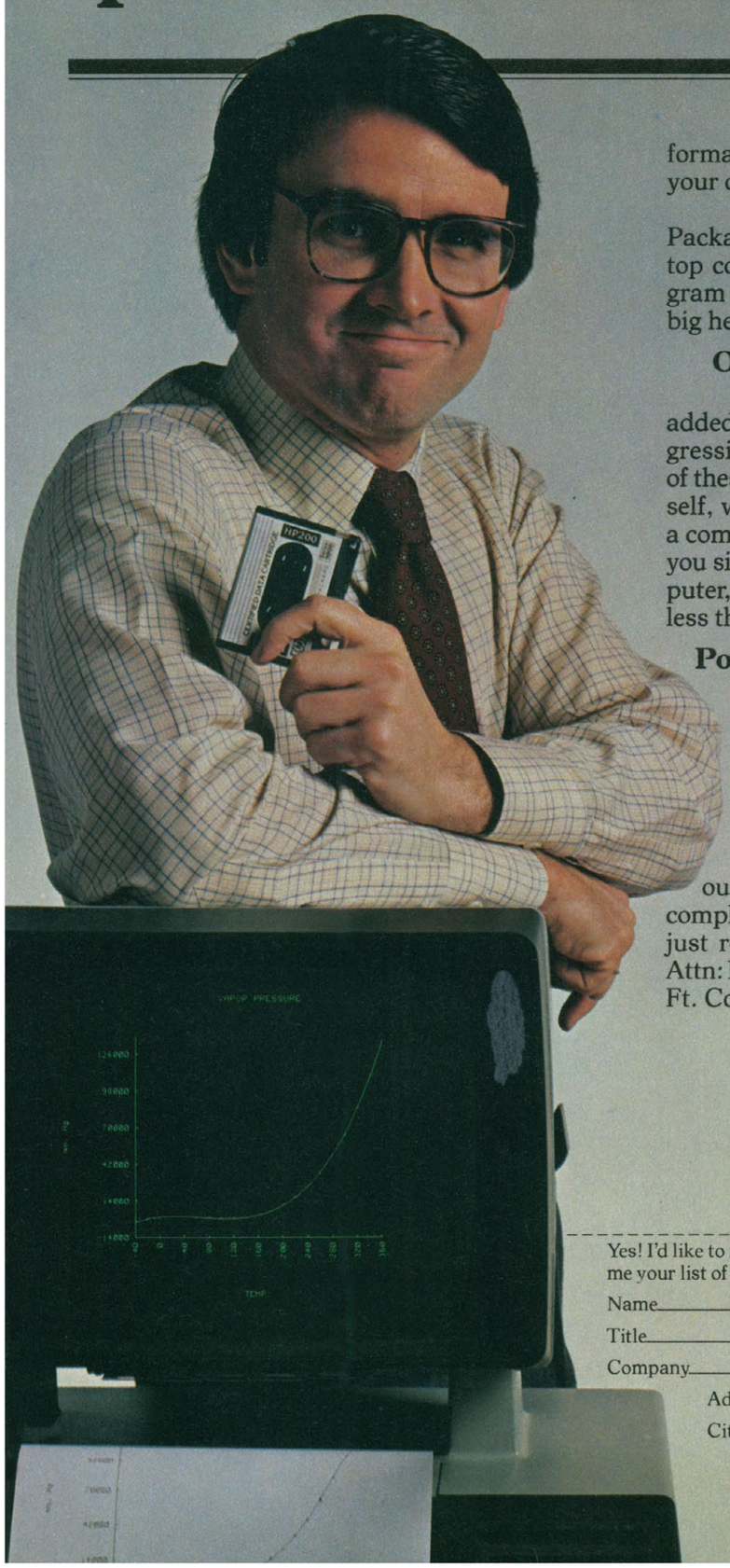

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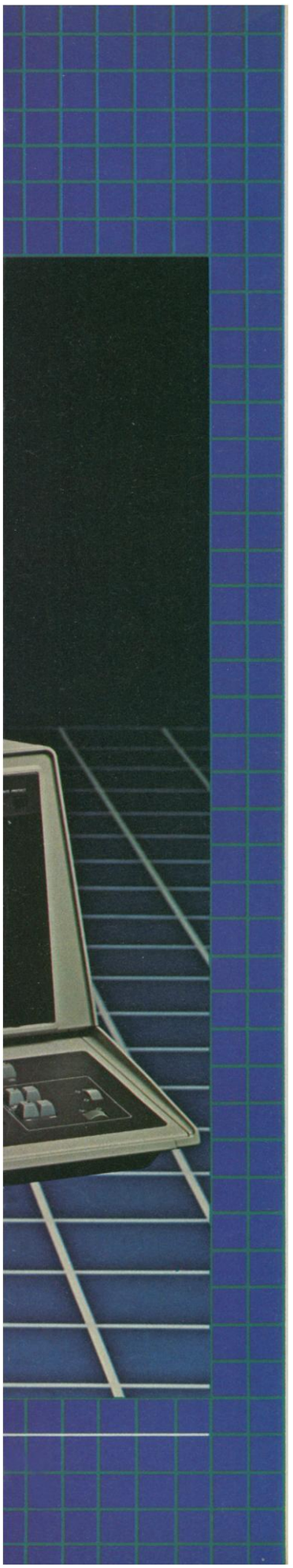

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Add optional memory planes for building multi-layer displays or for shading panels with up to eight levels of gray. Integral disk storage is optionally available.

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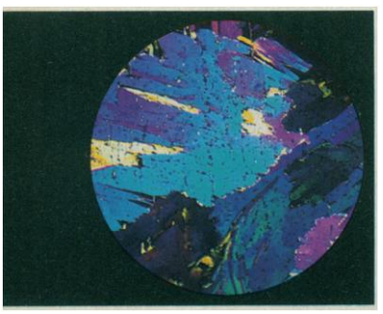

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17 July 1981, Volume 213, Number 4505 **SCIENCE**

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Abortion and the Limitations of Science

The Congress of the United States has asked medical science to tell it when human life begins. The very asking of the question by a legislative body, the directing of the question to the field of inquiry known as science, and the answering of the question by scientists indicate a misunderstanding of the appropriate roles and relationships of science and jurisprudence.

Science is only one of a number of valid fields of inquiry, and it must not take on itself the responsibility for providing answers to questions outside its proper realm. Science deals with the prediction and explanation of events in the physical (including biological) world. Far from dealing with absolutes of truth and right, it attempts to construct a hypothetical model of reality which reflects as closely as possible the world perceived by our senses and, when our senses are insufficiently precise, by our instruments.

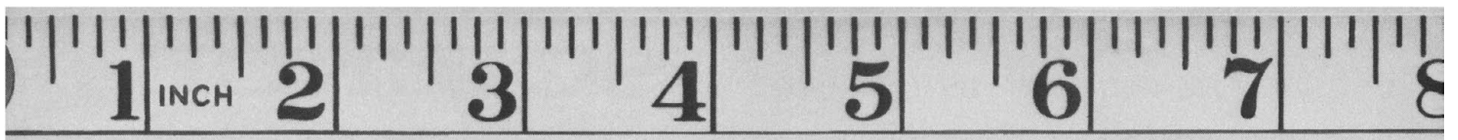
Life, in a scientific sense, is a hypothetical construct which is valid only to the extent that it aids in accurately conceptualizing the biological world. It is a powerful concept precisely because it has performed that function so well. But life, to the scientist, is not an elemental quality, as were earth, fire, air, and water to the ancients. It is a state of being, a matter of definition, and the line between life and nonlife is not always drawn easily. Is the smallest known virus particle alive?

This same discussion can be applied to any scientific conceptualization or definition, including the definition of human. The scientist, as a model builder of perceived reality, is justified in defining life, and in defining human, and in concluding that within this scientific conceptual model the fertilized egg of a human being is in itself a human life.

Jurisprudence, as a field of scholarship, and legislative action, as one of its practical applications, are concerned with very different sorts of inquiry. Broadly speaking, the law has as its purpose the establishment of a code of conduct to govern the actions of the members of a community in order (at least in our society) to enable them to best live together in harmony. One of the most basic functions of the law must then be to identify those actions which are abhorrent to the community and outlaw them. Thus murder, considered abhorrent by most members of most communities, is widely regarded by the law as the most serious of crimes. And so the law wants science, the definer of life and the definer of human, to tell it when human life begins, so that it may know when to define its ending as a crime.

It must now be clear that the human life of the scientist's perceptual modeling and the human life whose inviolability the law seeks to ensure are coincidentally the same words used in two entirely different conceptual frameworks. The law wants to know if the zygote, embryo, and fetus are human lives because it wants to know if these entities are entitled to the same rights and protections which the community has agreed to confer on human beings who have already been born.

The issue is thus not whether the zygote, embryo, and fetus are human lives in a scientific, definitional sense. The asking of that question is testimony to a profound misunderstanding of the capabilities and limitations of science. The issue is at what stage of development shall the entity destined to acquire the attributes of a human being be vested with the rights and protections accorded that status. It is to the moral codes of the people that the law must turn for guidance in this matter, not to the arbitrary definitions of science. The people are, of course, divided; the separate and combined influences of religious belief, secular morality, personal experience, blind emotion, and even caprice will be felt on all sides of the issue. It will be the difficult task of the lawmakers to create from this turmoil a reasoned and just code of action, but these are the voices which must first be heard. Science may never make moral judgments; the law must. To ask science to define human life in scientific terms for use by the law in moral terms is a travesty of both honorable traditions.—BRIAN G. ZACK, *Department of Pediatrics, College of Medicine and Dentistry of New Jersey—Rutgers Medical School, Middlesex General Hospital, New Brunswick 08903*



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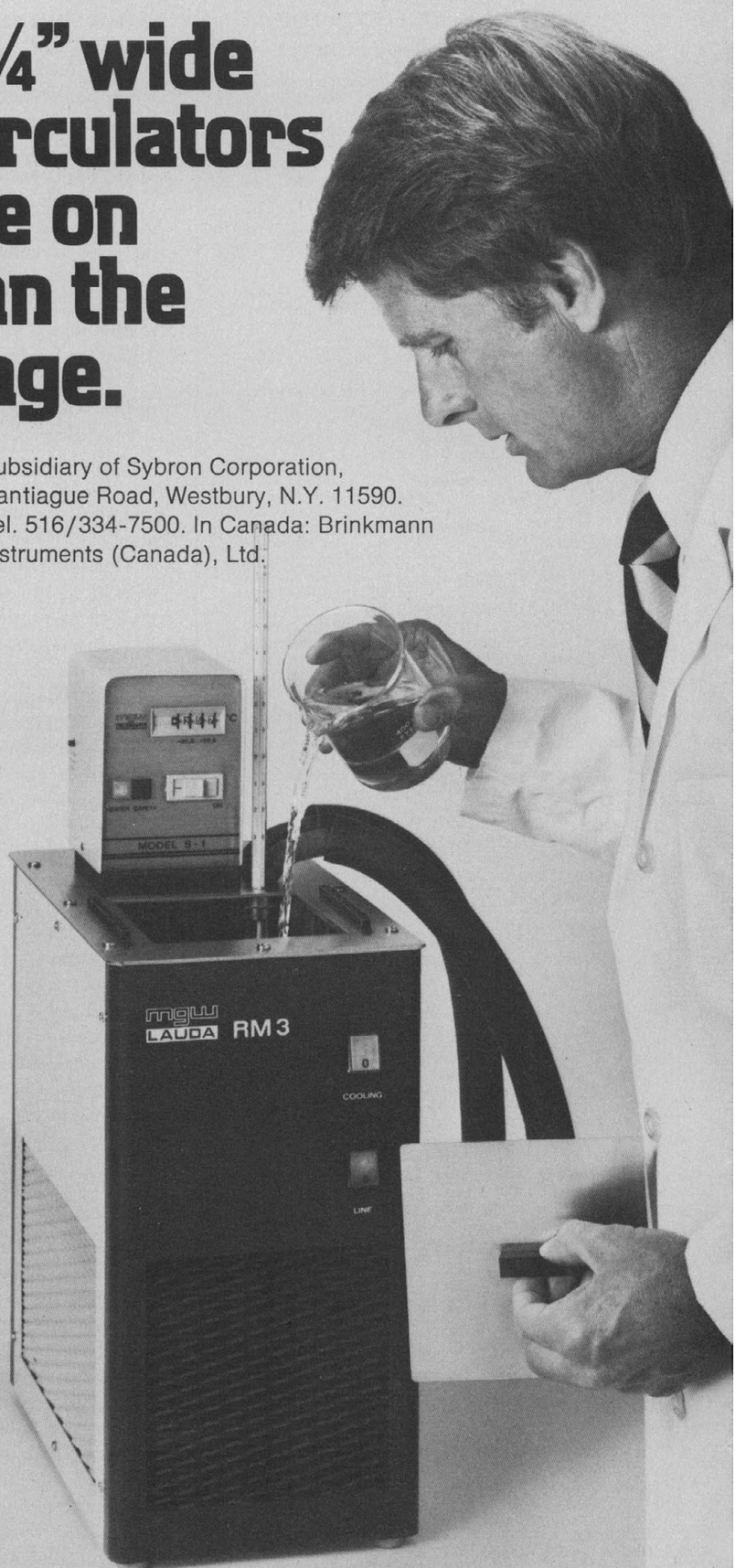

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