American Association for the Advancement of Science

SCIENCE

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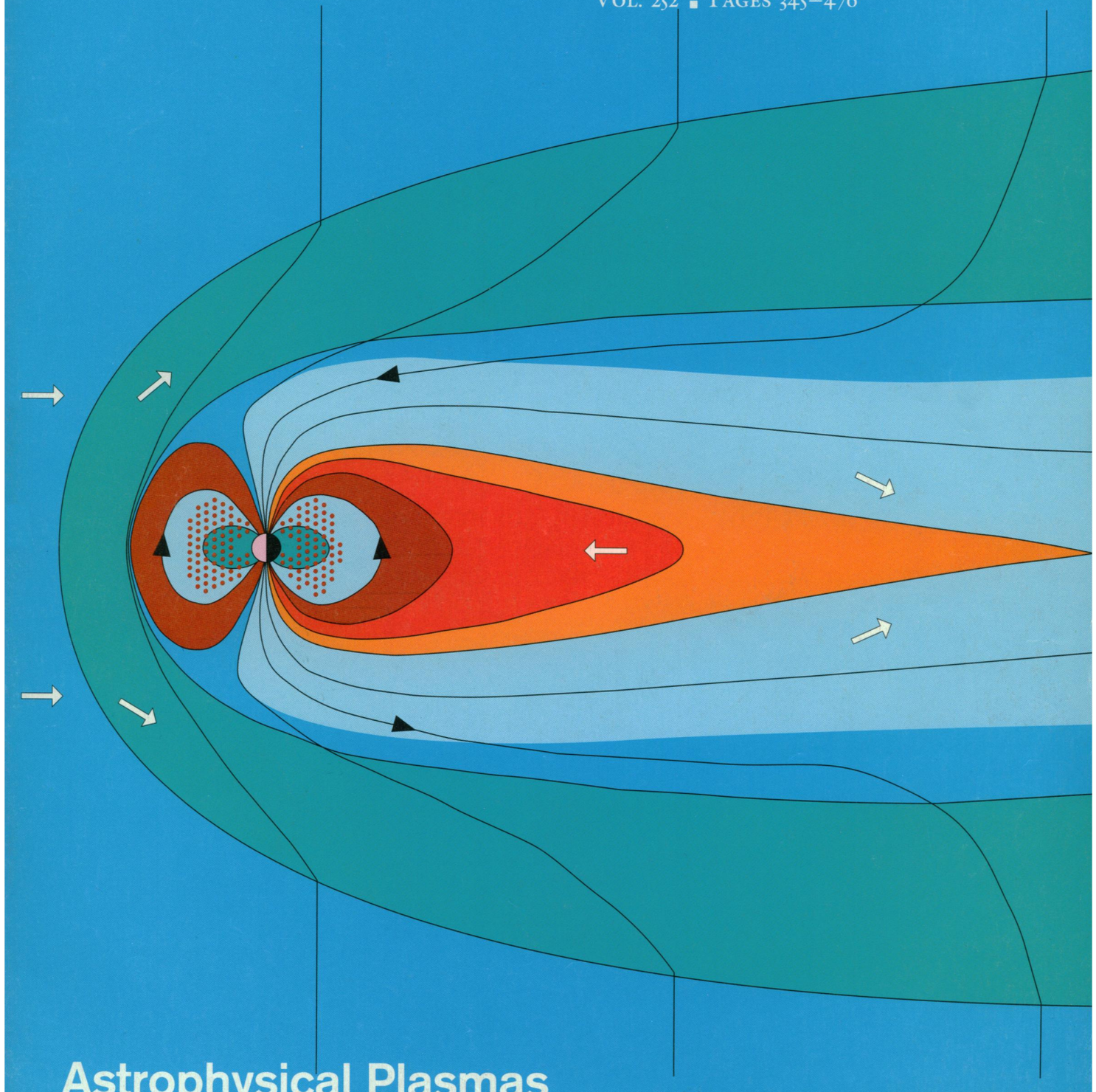
Vol. 252 ■ Pages 345–476



Astrophysical Plasmas

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StrataClean resin is designed for extraction of restriction endonucleases and many DNA modifying enzymes from nucleic acids. Quantitative removal of restriction enzymes from DNA can be accomplished in a matter of minutes with StrataClean resin and eliminates the hazards associated with liquid phenol extractions. The StrataClean resin extraction relies on the use of patented hydroxylated silica particles which exhibit characteristics similar to phenol[1,2].

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1. U.S. Patent Serial No. 4,923,978
2. Strategies Vol. 3 Number 4

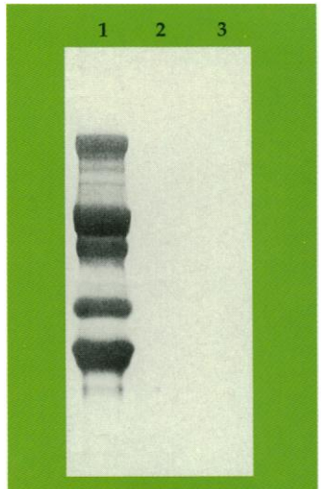

Figure 1 is a photograph of a silver stained SDS-PAGE gel. Lane 1 represents twenty micrograms of protein molecular weight markers. Lane 2 represents the residual protein following StrataClean resin extraction of twenty micrograms of the molecular weight markers. Lane 3 represents the residual protein following phenol/chloroform extraction of twenty micrograms of the protein markers.

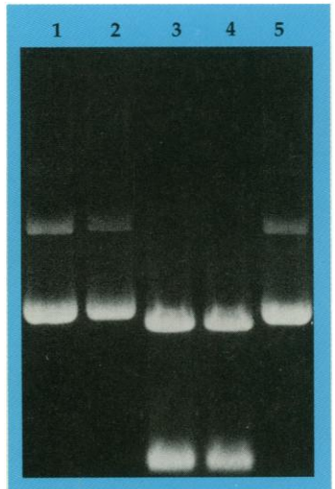

Figure 2. Ethidium stained agarose gel. Lane 1: control uncut plasmid DNA, Lane 2: the same DNA after standard StrataClean resin extraction, Lane 3: plasmid DNA digested with 4 units Pvu II, Lane 4: plasmid DNA after standard StrataClean resin extraction then digested with Pvu II, Lane 5: 24 units Pvu II extracted with StrataClean resin from 20 microliters of 1X Universal buffer, plasmid DNA then added and incubated at 37° C for 18 hours.

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PURIFICATION METHOD	TRANSFORMATION EFFICIENCY
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Phenol/Chloroform	$2.70 \times 10^8/\mu g$

The table lists the results from triplicate sets of transformation experiments. Ten micrograms of control cesium banded pBS DNA was digested with Eco RI. Five micrograms of the digested control DNA was purified using phenol/chloroform and 5 micrograms was purified with StrataClean resin. Samples were quantified, ligated and transformed according to XL1-Blue competent cell protocol.

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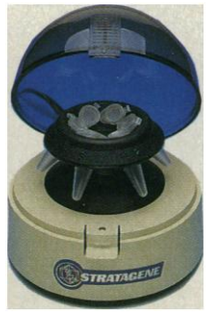

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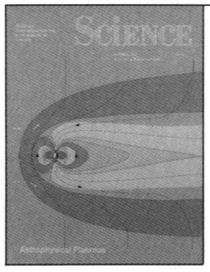

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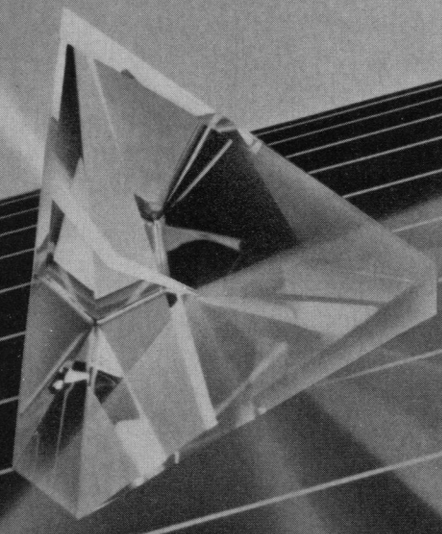

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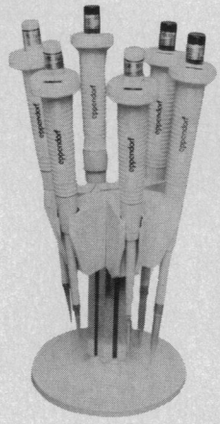

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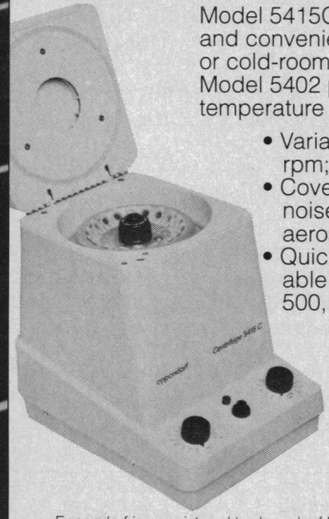

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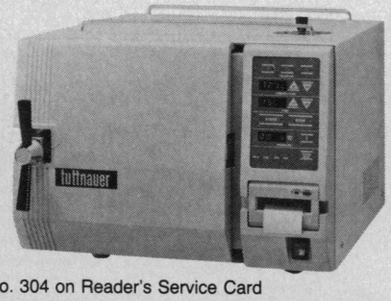

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Astrophysical plasmas

ASTROPHYSICAL jets, the solar wind, the interstellar medium, and the magnetospheres of planets are among the fascinating cosmic phenomena that are the subjects of this week's special issue (pages 384 to 415). Within the structures and dynamical peculiarities of these plasmas reside important clues to how the universe formed and how it has been evolving. An overview of the import of this topic and the content of the five articles is provided by Voss (page 353).

Autopoietic Gaia

LYNN Margulis has a good track record (page 378). Her first contentious theory, that mitochondria and other subcellular organelles evolved from bacteria and algae, is now dogma. Will time prove her current iconoclastic hypothesis—autopoietic Gaia—to also be correct? Behind autopoietic Gaia lies the notion that evolution acts at the level of symbiotic systems (such as human beings filled with *Escherichia coli* and other microbes) rather than through accumulations of mutations in the DNA. Autopoietic (self-maintaining) systems, which can be small like bacteria or large like earth, consist of living organisms and environments that are successfully interacting and codependent. Integrated in autopoietic Gaia are concepts and data from geophysics, atmospheric chemistry, and microbiology, which currently stand as nonoverlapping areas of science. Mann's News story presents a profile of Margulis and her theories and a discussion of the reception autopoietic Gaia has received within and outside the scientific community.

Laser-generated diamond thin films

DIAMOND, because of its high electrical resistivity and high heat conductance, would make an ideal material for electronic devices, and thus device manufacturers and materials scientists have sought techniques for growing single-crystal diamond thin films on nondiamond substrates. A new laser method accomplishes this goal (page 416). At room temperature a thick layer of carbon ions is implanted in the surface of the substrate. Then short (nanosecond) ultraviolet laser pulses melt the top layer of the substrate, which causes the carbon to rapidly assemble into diamond film. Through a combination of analytic procedures, including microscopic, spectroscopic, and diffraction techiques, it was possible to confirm that defect-free single-crystal diamond films were created on the single-crystal copper substrates. Narayan *et al.* follow up their experiments with simulations that show how laser heating and subsequent rapid cooling of the carbon ions and the copper substrate can account for the formation of the diamond phase. Further analysis of this work is presented by Amato (page 375).

Superantigen in mouse AIDS

AN AIDS-like syndrome (MAIDS) develops in mice that have been infected with certain murine retroviruses. One of the signs of this syndrome is massive proliferation of T lymphocytic cells, which is puzzling considering that clinically the disease is characterized by profound immunodeficiency. In MAIDS, stimulation of T cells seems to be induced by *gag*-encoded proteins of the infecting viruses; these proteins are expressed on the surfaces of B cells (page 424). The *gag*-encoded molecules have properties of superantigens, a group of potent molecules that activate subsets of T cells by reacting with portions of the T cell receptor (in this case with its $V_\beta 5$ chain). Hügin *et al.* question whether other viruses including endogenous viruses also might use the superantigen route to induce pathologic immune responses and note that, once a superantigen has stimulated a subset of T cells, lymphokines will be released that could then go on to more broadly activate additional cells of the immune system.

A better mouse model

VARIOUS models involving immunodeficient mice have been assessed for studying the differentiation, maturation, and responses of human T and B lymphoid cells. A method is now described by Lubin *et al.* for studying these cells and their maturation in normal mice (page 427). The mice were pretreated with a lethal dose of radiation that caused depletion of endogenous hematopoietic (blood) cells. Mice treated in this way normally die after 2 weeks, but long-term survival was made possible by injecting the mice with a combined preparation of bone marrow from both immunodeficient mice and normal humans. The mouse cells quickly reconstituted all hematopoietic compartments of the body except those leading to T and B cells; the human T and B cell progenitors developed slowly, appearing first around 7 weeks and peaking at 4 to 5 months.

Release mechanism

A NUMBER OF PROTEINS ARE ANchored into cell membranes by phosphatidylinositol-glycan (PI-G) molecules. The anchoring molecules can be cleaved in vitro in the presence of detergents by the enzyme PI-G–specific phospholipase D (PI-G PLD), but PI-G PLD cannot release proteins anchored to the surfaces of intact cells. Scallon *et al.* have determined the primary structure of bovine PI-G PLD and found that coexpression of the enzyme with a suitable protein in cells in culture results in cleavage of protein molecules from their membrane anchors and release of the protein into the extracellular medium (page 446). Thus, PI-G PLD seems to act at an intracellular location. Interestingly, the expression of PI-G PLD by the cell appears to enhance production of the protein. Release of anchored proteins and their altered expression may be important physiologically in part because other molecules released during the cleavage participate in the transduction of signals for various biological processes.

■ RUTH LEVY GUYER

April 15, 1991

Lab Book # 22
page 350

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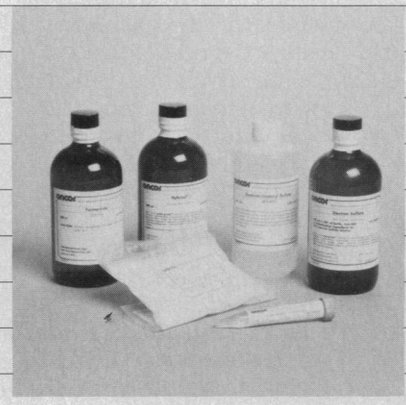

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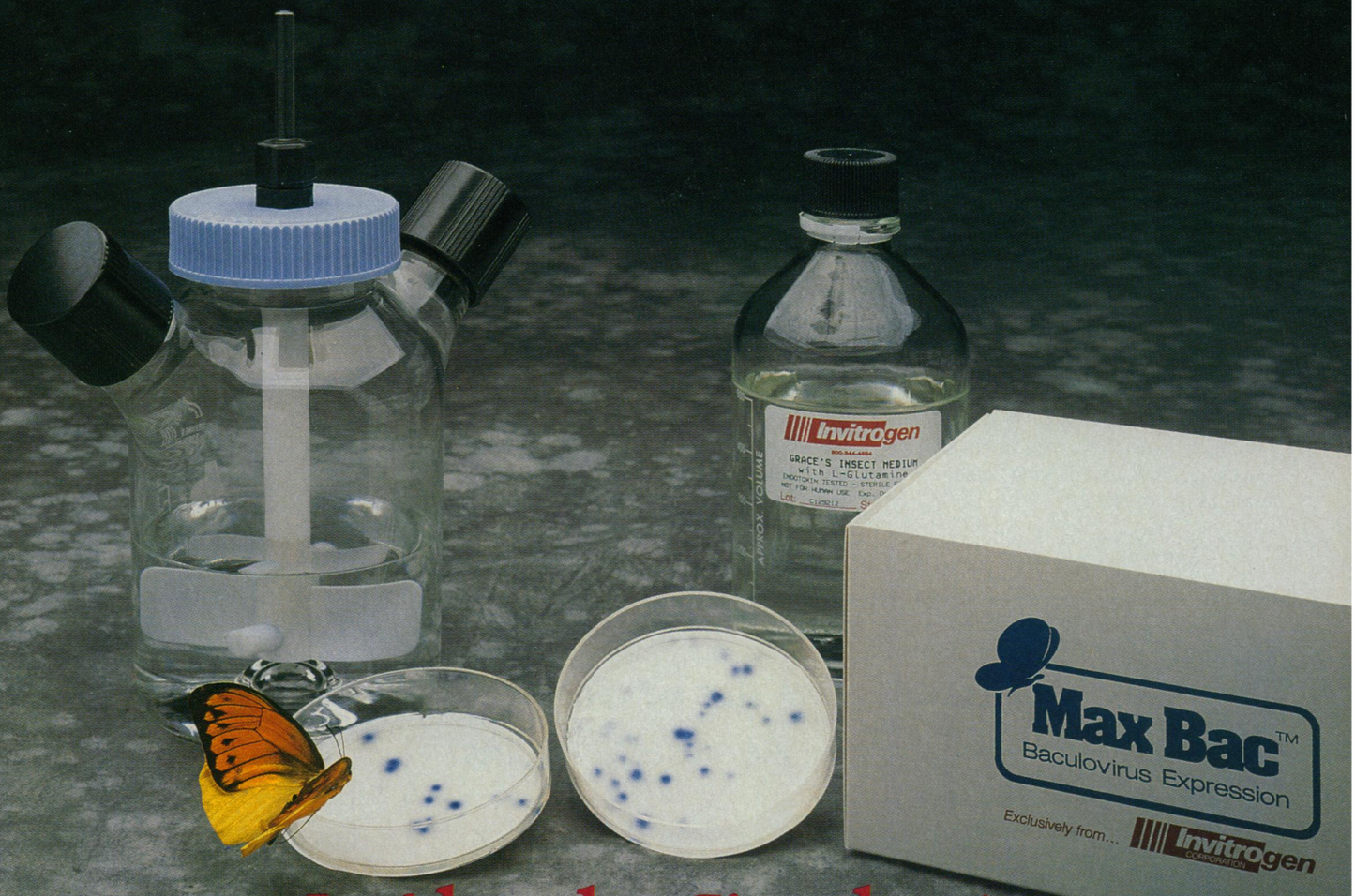

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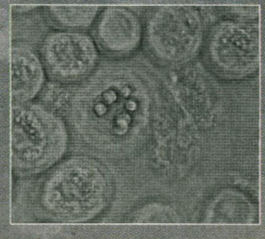

Figure 1. Infected Sf9 insect cells showing viral occlusions.

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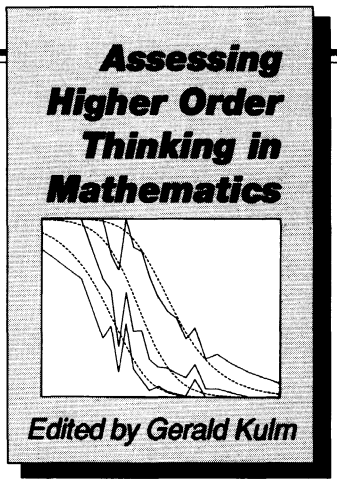
Education books from AAAS

Assessing Higher Order Thinking in Mathematics

Edited by Gerald Kulm



Teaching higher order thinking is essential in today's world. And what is taught must be tested. Unfortunately, most mathematics tests focus primarily on rote computational skills and memorized facts rather than on higher order thinking. This book addresses such concerns. The authors explore new approaches to mathematics assessment, provide directions for reforming mathematics testing, and give examples of innovative test items. It is especially valuable for teachers, test publishers, researchers, and federal and state educational policy makers.

Topics include: A new world view of assessment in mathematics; power items and the alignment of curriculum and assessment; assessing student growth in mathematical problem-solving; computer-based mathematics assessment; calculators and mathematics assessment; students' theories about mathematics and their mathematical knowledge; assessing schema knowledge for arithmetic story problems; critical evaluation of quantitative arguments; investigation of structured problem-solving items; and new directions for mathematics assessment.

1990; 216 pp.; indexed
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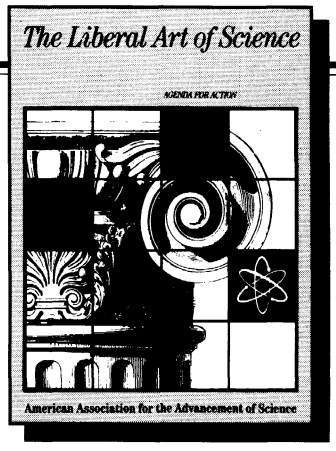
The Liberal Art of Science

Agenda for Action



This report presents the conclusions and recommendations of the AAAS Project on Liberal Education and the Sciences. It discusses the level of scientific understanding necessary for optimal participation in 21st century life and the type of undergraduate science education required to achieve such a level of understanding. In addition, this volume supports the idea that science is a liberal art and should be taught as such. It recommends goals for liberal education in the sciences, outlining the multidisciplinary curriculum and teaching strategies necessary to achieve them.

An appendix includes descriptions of existing courses and programs, offered at institutions nationwide, that are consistent with the project's recommendations. This report is of particular interest to undergraduate science educators as well as to all people committed to quality science education.

Topics include: Agenda for action; faculty responsibility; resource commitment; teaching materials and technologies; assessment instruments; the nature of scientific explanation; historical context; pedagogical techniques; integrating multidisciplinary content; programmatic approaches to liberal education in science; and liberal education for special groups such as future science teachers, the underrepresented in science, people with disabilities, and science and engineering majors.

1990; 142 pp.
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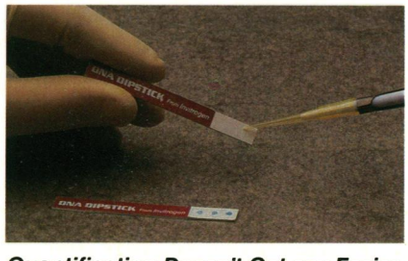

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