SCIENCE 24 September 1971

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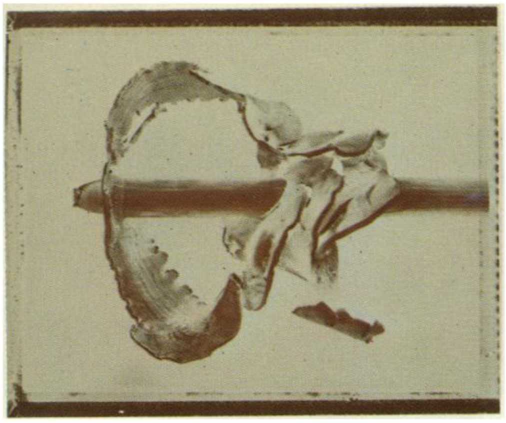
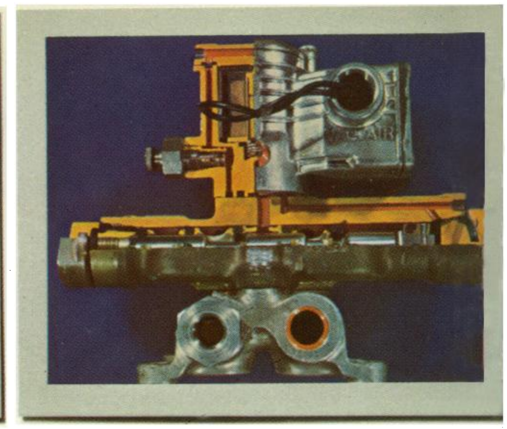
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Index Issue

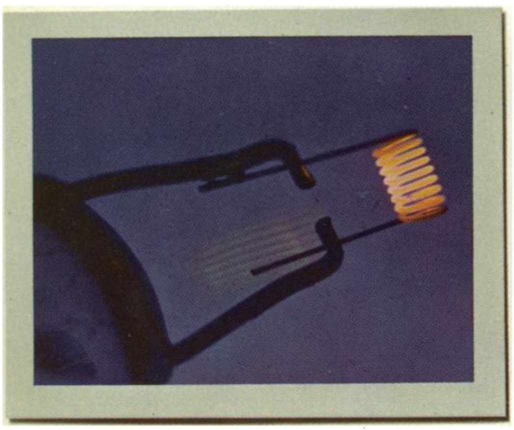


Tensile fracture of copper wire (negative).

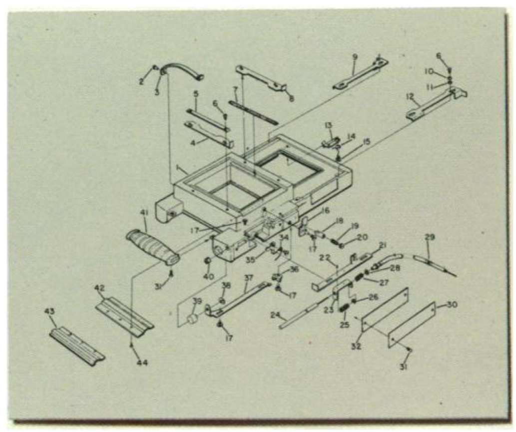
Photomicrograph of p-Nitrophenol crystals.



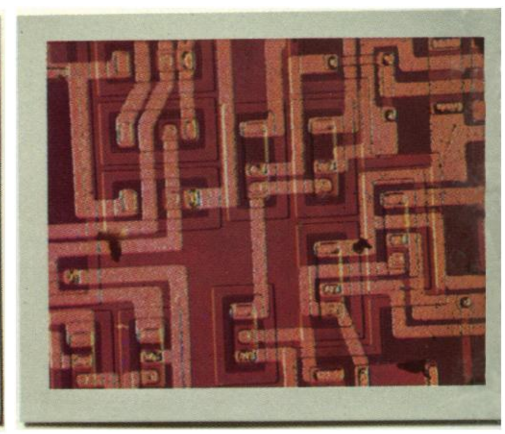
Record of prototype design.



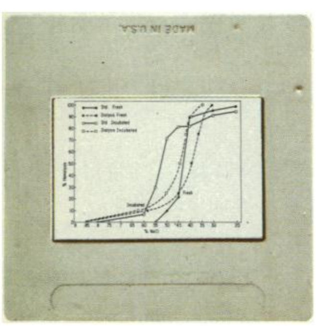
Macrophotograph (10X) of glowing lamp filament.



Reduction copy of engineering drawing.



Photomicrograph of integrated circuit.



35mm slide from chart.

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And you don't have to be a skilled photographer to use it. Just put your subject on the evenly lighted baseboard, select the film you want, focus and press the button.

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You can use the MP-3 for recording prototypes for your file, for making a quick record of a transient chemical reaction, for documenting production flaws or making step-by-step records of destructive testing. The MP-3 can deliver prints or slides of any industrial or scientific subject, and deliver them fast.

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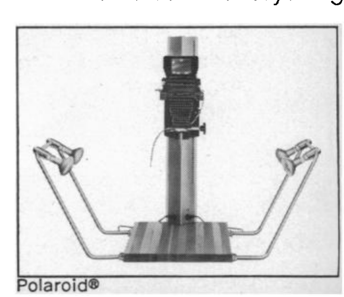

24 September 1971

Vol. 173, No. 4003

SCIENCE

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COVER

Infrared rainbow. Photograph was taken with infrared sensitive film and filters which exclude all visible light. See page 1231. [R. G. Greenler, University of Wisconsin, Milwaukee]

Some things are changing for the better...

Whatever your job, here's a calculator that speaks your language. You can customize its keyboard, memory size, display, programs and peripherals to suit your number-crunching tasks.

Many people know us as an instrument manufacturer: we make more than 2,000 products for measurement, test and analysis. Others know us as a computer company: more than 10,000 own our programmable calculators and computers. We prefer to think that our business is to serve measurement, analysis and computation needs . . . in science, industry, medicine and education. This is the rationale behind every new instrument, computer or system that we tell you about in these ads. This month:

For picky people with particular problems: A design-your-own calculator

A user in virtually any discipline now can customize a powerful new programmable calculator to his specific computational needs.

An agronomist, for example, may want to examine the characteristics of a large plant population and determine the mean, standard deviation and standard error of their distribution. With the Model 10, he simply enters the raw data and hits a single key for the complete statistical analysis. A chromatographer can obtain per cent concentration and relative retention time of each component on his chromatogram . . . at a single keystroke. A physicist completes a sequence of acceleration, velocity, force and work . . . and a clinical pathologist computes a full blood gas analysis . . . at a single keystroke. Et cetera.

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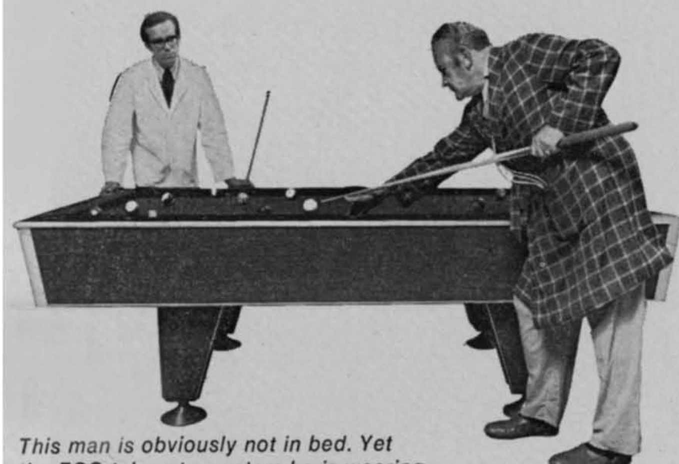

This man is obviously not in bed. Yet the ECG telemetry system he is wearing enables nurses at a central monitoring station to keep close watch on his heart action.

Freedom with protection for the post-coronary patient

Once the coronary patient is released from the intensive care unit, his recovery can often be aided by freedom to move about and mild exercise . . . provided his ECG can be continuously monitored.

With the new HP ECG Telemetry System, the post-coronary patient can be ambulatory. Wherever he goes, his heart action is transmitted to a receiver at the nursing station where it can be continuously observed. The transmitter is small enough to be carried comfortably in a bathrobe pocket, has a strong enough signal to reach the nursing station from 200 feet even through several masonry walls, and is rugged enough to operate reliably even if dropped.

At the nursing station, the patient's ECG signal is monitored by a receiver that operates automatically, never requires tuning and accepts only valid signals, minimizing artifacts from patient motion. An automatic warning light alerts the nurse of such inoperative conditions as: patient out of range, dislodged electrode, low battery power. It is completely compatible with HP patient monitoring systems. Because it doesn't require new wiring, the ECG Telemetry System is easily introduced into existing facilities. Price is $1,800 for each patient unit. Write for our new illustrated brochure.

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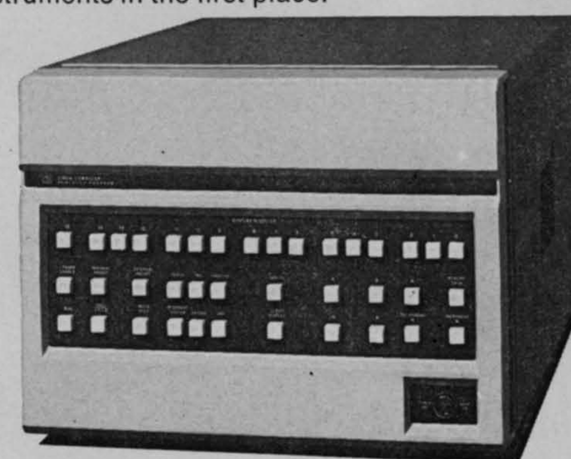
Once it rolls through your door, the 2100 resists replacement by expanding as your needs increase. Starting with its smallest configuration for only $6,900, you get a powerful computer that understands your instruments. Fourteen input/output devices and peripherals, and dozens of instruments, can be plugged directly into the 2100. HP has a big advantage here because we probably made many of your instruments in the first place.



The 2100 is more than just a pretty face. This easily expandable mini can toil as a general purpose digital computer, be dedicated to specific applications, or work in modular automated systems.

When you need more capability, you merely plug in additional memory and hook on peripherals. Smaller and nearly twice as fast as preceding models, the 2100 can expand from 4K to 32K of core memory, all within its 12-inch high mainframe. The same 2100 you start with can be upgraded to a time-sharing, batch processing or automated measurement, test or analysis systems.

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parametric oscillators or dye lasers

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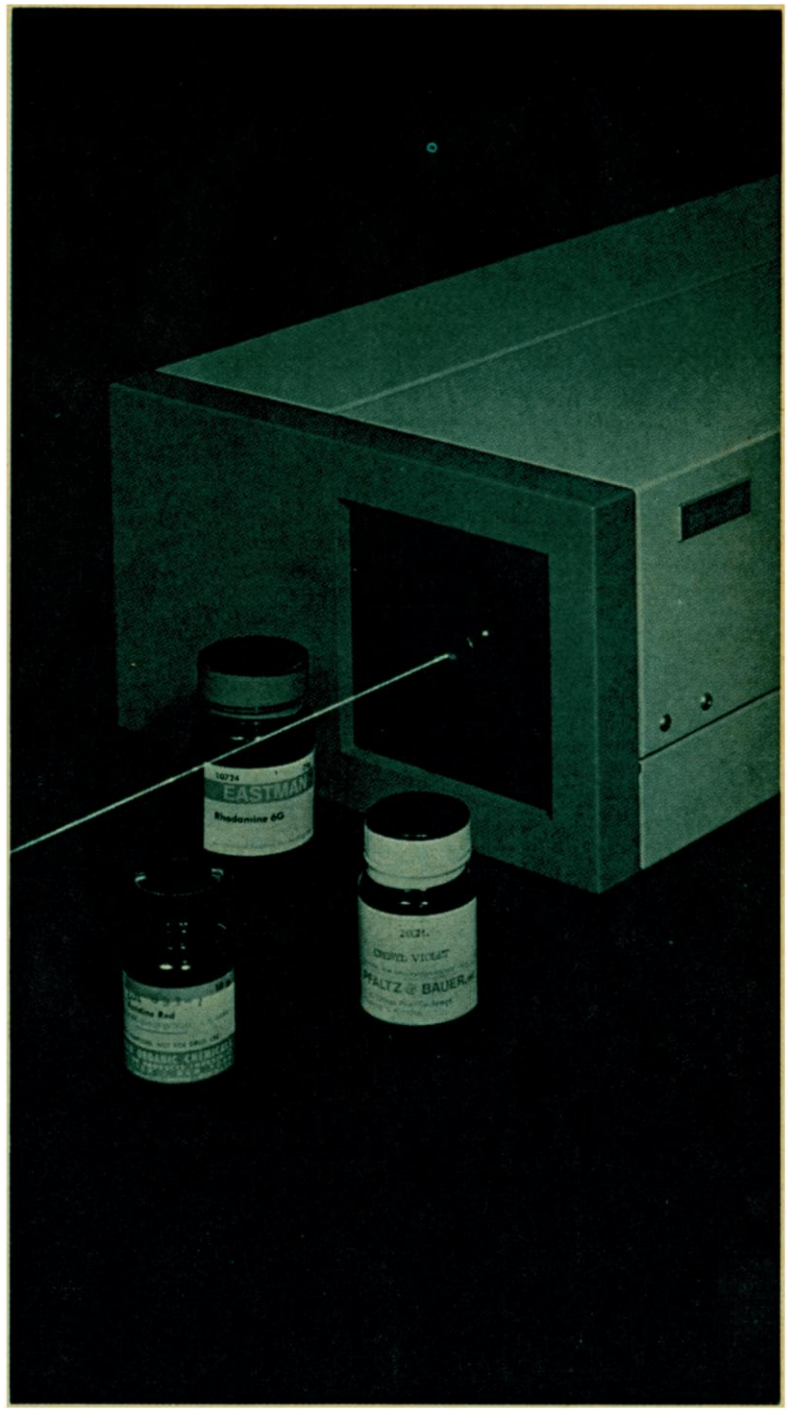

TABLE 1: Model 1000 Specifications

WAVELENGTH μ	PEAK POWER TEM_{00} (kW)	NOMINAL PULSE LENGTH Half Amplitude (ns)	AVERAGE POWER TEM_{00} (mW)
0.473	2.0	300	30
0.526	2.0	125	70
0.531	2.5	110	100
0.532	3.0	200	400
0.537	2.0	125	80
0.556	1.5	300	100
0.558	2.0	250	150
0.562	2.0	300	150
0.659	2.5	110	150
0.667	2.5	110	150
0.679	2.5	125	100

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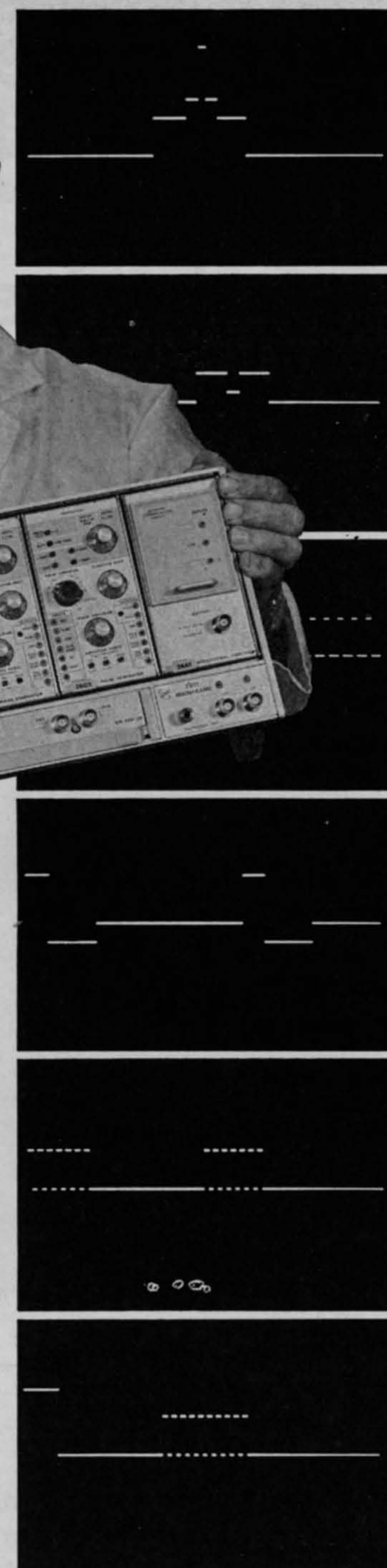
the 2600 Series is even better than my 160 Series



The TEKTRONIX 2600 Series offers price/performance superiority over existing systems . . . even the long-famous TEKTRONIX 160 Series. Modular construction allows the 2600 Series to perform generation, conditioning, isolation, amplification and mixing tasks with superb flexibility.

A 2600 system consists of a mainframe and from one to six plug-in modules plus optional interconnecting boards and stimulus isolators. Storage and nonstorage oscilloscopes and monitors can be easily added.

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Signal Isolation—True differential stimulus isolation, greater than 1×10^{10} ohms, is produced by the 2620.

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Signal Amplification—Differential CMRR up to 5×10^4 with up to 1×10^5 gain with the 26A2 Amplifier. Signals amplified are in the range from DC to 1 MHz. Input resistance is selectable: 1 megohm or 200 megohm.

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- R2601 Rackmount Mainframe .. $495
- 26G1 Rate/Ramp Generator $430
- 26G2 Ramp Generator $300
- 26G3 Pulse Generator $485
- 26A1 Operational Amplifier $280
- 26A2 Differential Amplifier $550
- 2620 Stimulus Isolator $450

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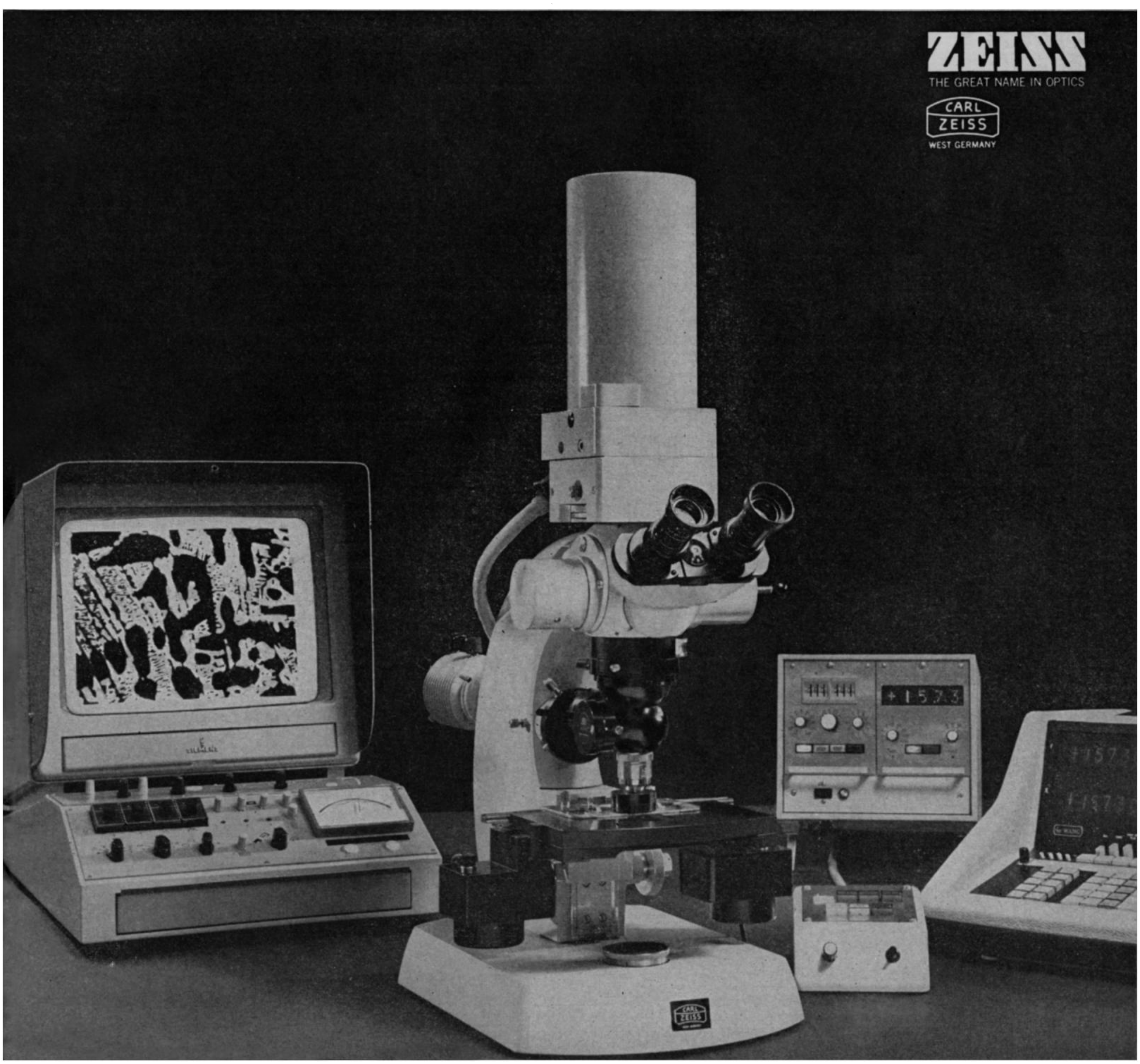

super-micro-computer

Olivetti Corporation of America
Marketing Division, Department
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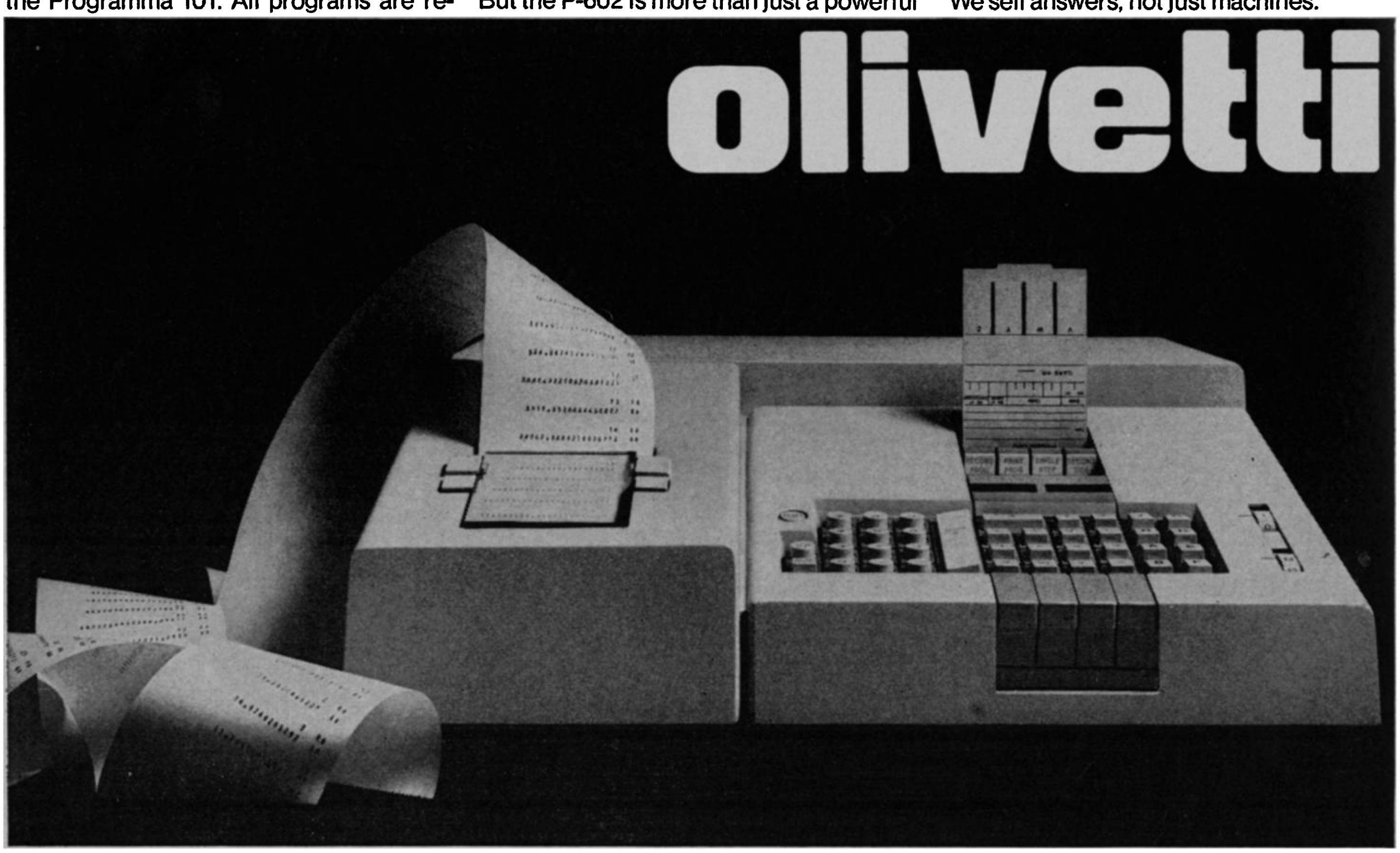

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Science, as distinguished from technology, is a common intellectual endeavor. The emphasis must be on "common." We stand on the shoulders of our predecessors, we support one another, and our successors stand in turn on our shoulders. Personal insight alone is not enough in this endeavor. We have to communicate our findings and our thoughts in language and symbolism that are as unambiguous as we can devise. The goal of scientific investigation is not simply to gain personal insight, but to gain it in such terms that we can, ideally, transmit it undiminished to another mind. Perhaps this mode of communication, which seeks to inform and to cement mutual insights in specific guise, can be contrasted with poetry. A poem that stimulates can be great even if its intended meaning is in doubt. Books can be written debating its meaning, and its value is only enhanced. In the case of a great scientific theory, matters are qualitatively different. Books can be written about its uncertain implications, or about its failings in fact or logic, but uncertainty as to its intended meaning must reflect an inherent flaw. If it is ambiguous, it cannot form the basis for common knowledge.

If raw sensuality is to be injected formally into the scientific endeavor, the challenge, then, is to devise means not only to gauge its import initially, but also to communicate its import in terms precise enough to provide a common ground for agreement. The obvious hazard is that an incomplete attempt will only provide grist for controversy among individuals whose senses differ for biological or cultural reasons. The extreme difficulty of avoiding this posture must be recognized. Public decisions to ignore, modify, amplify, or discount specific scientific insights or judgments for humanistic or political reasons, both moral and expedient, are commonplace. Sensuality of one kind or another plays a large role, and inevitably so, in these actions. Until the force of this sensuality can be expressed in a fashion more concrete than the sort of vague imagery that is customary, it would only cloud issues further to suppose that the sensuality is an integral part of the related scientific edifice under either construction or attack.

Make no mistake. I do not reject sensuality. All science is based on sensory observation or detection of some kind. I merely contend that to welcome sensuality in the abstract is to beg the question. This question is whether or how sensuality, as Blackburn uses the term, can be made systematic and communicable enough to become a part of common endeavor, rather than personal quest, for which it is assuredly the indispensable factor.

William R. Dickinson
Department of Geology,
Stanford University,
Stanford, California 94305

Blackburn has helped me express thoughts that I had been unable to formulate for years.

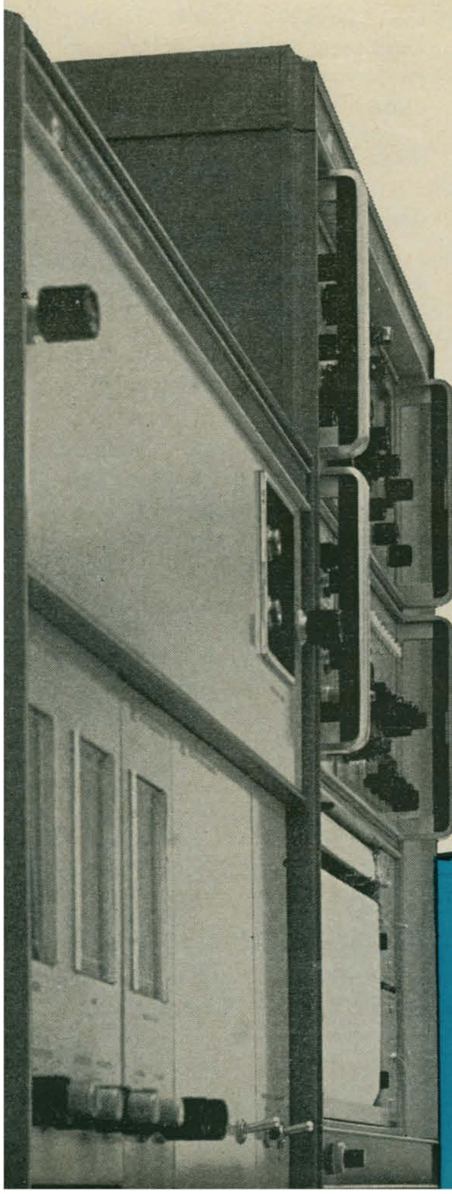
Science teaching in the universities and in the high schools has become increasingly abstract during the past 20 years. Far from becoming more modern, we are dangerously approaching the scholastic mentality of the Middle Ages.

The general biology courses that are taught at the beginning of a scientific or liberal arts curriculum give information on abstract concepts which the students cannot comprehend because of lack of practical experience with specimens. Freshmen who take these courses must memorize and learn to manipulate abstract concepts and even come to logical conclusions without ever comprehending the contents of the exercises. Indeed, very few teachers truly understand the contents of these courses. The end results of the lifelong labors of great scientists are presented in ready-made form.

Educators have forgotten that those scientists who have made the modern discoveries could not have accomplished their feats without a thorough familiarity with nature, which begins in childhood, in backyards, woods, and fields. Intelligent, meaningful science gradually develops with the observable world around us. This is the world of visible, audible, smellable, touchable, dissectible organisms, rocks, and minerals, the visible stars and clouds, and the feelable atmosphere.

Students ought to be guided from the "sensuously" perceivable to the theoretical explanation of the observable. This is the path along which all science has evolved and the only "relevant" road for teachers of science. It is impossible to awaken enthusiasm for science when the beginning is also the end result.

Hans Elias
Department of Anatomy,
Chicago Medical School,
University of Health Sciences,
Chicago, Illinois 60612



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The most important characteristic of the 7620's cryogenic module is its effectiveness. As evidence, we show the chromatogram of a complete separation of Argon from Oxygen in a sample of air, performed in 8 minutes on a 6-foot column (Molecular Sieve 5A) in a 7620 oven operated isothermally at −30°C. Any GC that can do this is clearly performing well in the sub-ambient region.

Still more evidence of the 7620's precision at sub-ambient temperatures is presented in Bulletin 7620, yours on request. Prices start at $5650 for a dual TC detector instrument; the cryogenic option adds $380. Hewlett-Packard, Route 41, Avondale, Pa. 19311. In Europe: 1217 Meyrin-Geneva, Switzerland.

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ANALYTICAL INSTRUMENTS

43004

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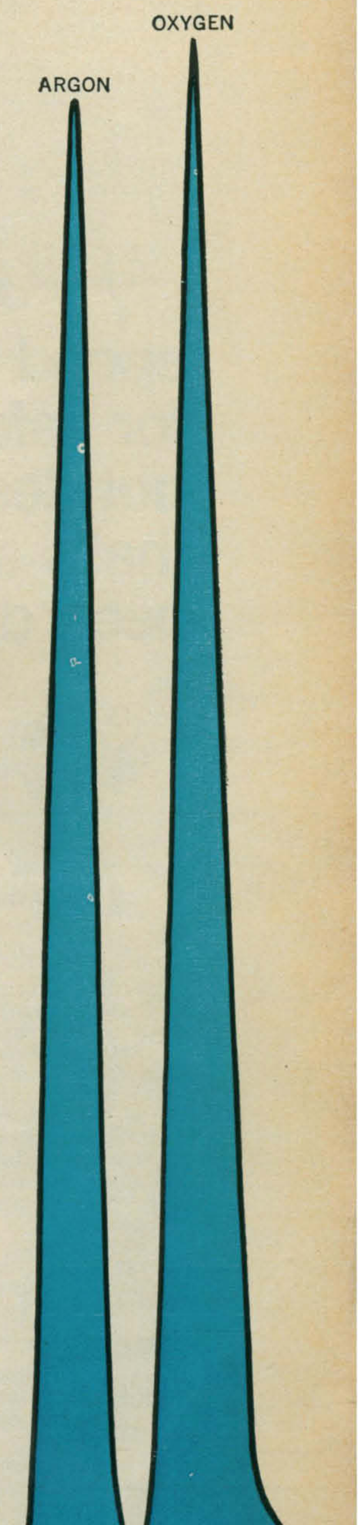

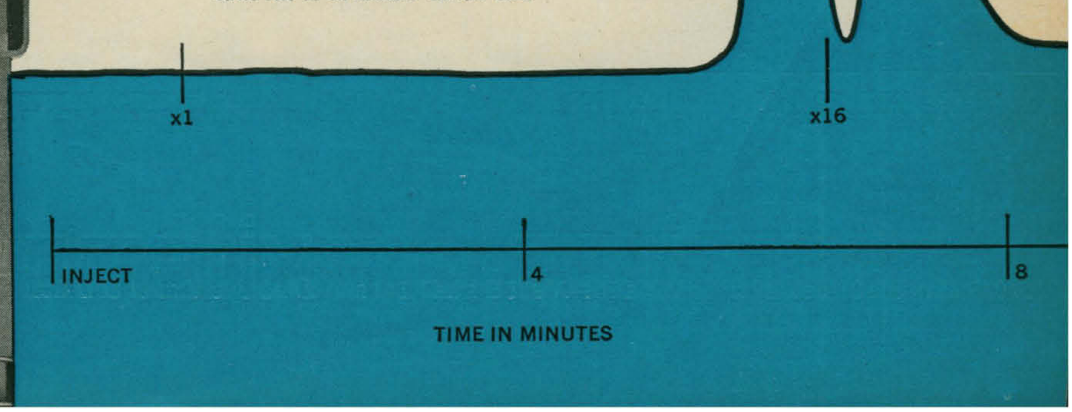

Analogy may be fruitful. Unsupported by logical argument it can be misleading, as Blackburn has indicated with his non sequiturs. To argue for a sensuous science from Bohr's principle of complementarity does justice neither to the idea nor to the man.

The particle and wave theories are two ways of looking at the same thing, but both were formulated and extended by rigorous mathematical analysis. Both are clearly in the mode described as "quantitative science," and their example provides no analogical support for Blackburn's leap into an alternative, sensuous domain. Furthermore, by equating intuition simply with sensuous experience, he ignores the whole history of scientific inquiry in the intellectual domain. Creative investigation has always been nurtured by intuitive insights, guesses, and hunches, but these have been tested later as rigorously as possible. After all, intuition can be wrong.

Finally, Blackburn is quite wrong when he excludes the holistic naturalist from the act of simplifying reality for the sake of intellectual comprehension. No one can define, let alone understand, the numbing complexity of reality. We are all of us quantifiers and feelers (and what emotion-laden words these are), homomorphic or many-to-one mappers and modelers. We select certain things and filter out the rest. The question is whether we should be more aware of the filters.

PETER R. GOULD

Department of Geography, Pennsylvania State University, University Park 16802

If the idea of complementarity is generalized from its precise, operational meaning in quantum physics, so that it becomes a broad philosophical tenet that takes into account the behavior of the human observer, it is wholly indistinguishable from the philosophical concept of pluralism as advocated by William James in *A Pluralistic Universe*, first published in 1909.

WALTER M. ELSASSER

Institute for Fluid Dynamics and Applied Mathematics, University of Maryland, College Park 20742

I had no intention of advocating unseemly leaps into alternative domains; that would be as big a mistake as to deny the human and scientific importance of sensuous experience. It is to the second error that I addressed myself, feeling that the first was relatively unlikely to occur within the house of science. Rather than reasoning by analogy from physical to sensuous-intellectual complementarity, I tried to generalize the idea of complementarity, and then to show that both types may be examples of a fundamental epistemological phenomenon—an enterprise, by the way, that Bohr himself pursued for the last 30 years of his life.

I agree entirely with Dickinson. Our codification, so to speak, of sensuous knowledge is centuries behind our analytical systems. In fact, as embodied in art and poetry, it has indeed become embedded in "personal quests," where it has shown, in capable hands, a very powerful precision. However, since at least the era of Goethe, Coleridge, and Faraday, the sensuous and the analytical have followed different concerns—to the detriment of both.

THOMAS R. BLACKBURN
Department of Chemistry,
Hobart and William Smith Colleges,
Geneva, New York 14456

Artichokes

I refer to the technical comment by Eisner and Halpern (25 June, p. 1362) on the article by Whittaker and Feeny (26 Feb., p. 757), on chemical interactions between organisms.

A less dramatic distortion of taste occurs after one eats artichokes, the flower heads of *Cynara scolymus*: things taste sweet.

W. M. WOODS
114 Tabor Road,
Oak Ridge, Tennessee 37830

Reciprocity

Sev S. Fluss (Letters, 11 June, p. 1083) complains that Russian scientific authors in citing non-Russian sources fail to give the original (that is, Latin) spelling of names along with the transliteration. Before the AAAS adopts his suggestion that it urge this worthy practice on the Russians, it might urge the editors of *Science* (and other American journals) to adopt the practice of including the Cyrillic spelling of Russian authors' names in citing them.

ROBERT G. GLASER
Department of Physics and
Astronomy, University of
Maryland, College Park 20742

24 September 1971, Volume 173, Number 4003

SCIENCE

Open Admissions: The Real Issue

When the City University of New York announced late in 1969 that it would admit all 1970 graduates from city high schools, an intensive controversy about "open admissions" was set off. What was largely overlooked by those on both sides of the debate was that several of the largest state systems of higher education have been operating under such a policy for many years. As other states and municipalities expand their higher educational facilities, open admissions as such will probably become a dead issue.

Indeed, the real issue all along has been not *who* gets in, but who gets in *where*. This question is particularly sensitive in those cities or states that have a hierarchical arrangement of institutions, whereby only the most able students may attend a few select colleges or universities, while the least able are shunted to junior or community colleges. This arrangement, which evolved within the private sector more or less by accident, has been adopted by some public systems (notably California) as a matter of policy, and now many states seem to be drifting toward some kind of hierarchical model. In the minds of many planners, the two-year college is appealing not only because it preserves and protects the selectivity of institutions at the top of the hierarchy but also because it is generally cheaper to operate.

Those who support the idea of keeping the least able students in separate institutions argue that it enhances the educational development of both the bright and the dull student. So far, the empirical evidence has failed to support this contention. It *is* clear, however, that such sorting of students has a number of unfortunate side effects, the most obvious being racial and socioeconomic segregation. For this reason, if for no other, the trend toward uncritical acceptance of the hierarchical model is to be deplored.

The idea that a previously selective college will be "wrecked" (as was recently alleged in one nationally syndicated column) if it moves to accept mediocre or poorly prepared applicants is simply not supported by the facts. For many years, a few of the country's major public universities have, apparently without suffering ill effects, been able to accommodate students who vary widely in ability. The transition from selective to open admissions will, no doubt, require certain curricular changes, but it can be done, although a long history of predictive studies shows that it would be folly to expect the student with relatively poor high school grades and low test scores to perform as well as the better-prepared students in the same courses. In certain respects, this would be like requiring the typical new freshman to take senior-level courses and expecting him to do as well as the seniors.

There are, of course, many structural models other than the hierarchical or vertical one that could and should be explored (a horizontal arrangement of institutions differentiated along curricular lines, for example). However, as institutional administrators and planners continue to scramble for limited funds, they are likely to pay less and less attention to the matter of alternative structures. This is not to suggest that new institutional forms will not be tried out (the "university without walls," for example), but that the existing hierarchical arrangement within state or city systems will be perpetuated and strengthened and that innovative forms will be merely added, like so much decorative gingerbread, to the main structure.—ALEXANDER W. ASTIN, *American Council on Education, Washington, D.C. 20036*


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mitter agents. With a sensitive radioassay, histamine was shown in highest concentration in the hypothalamus, was localized to synaptosomes with slightly different density than norepinephrine- or γ-aminobutyric acid–containing nerve terminals, was decreased by inhibition of histidine decarboxylase (turnover half-life only 5 minutes), and was affected by stress. It is clear that such transmitters as acetylcholine and norepinephrine account for only a very small percentage of all the synapses in the central nervous system; therefore, the evaluation of additional potential transmitter substances is an active field. No defined genetic diseases have been associated yet with an abnormality in neurotransmitter metabolism.

R. Rosenberg (University of California, San Diego) presented data on neuronal differentiation in vitro. He used both dissociated normal brain cells from neonatal BALB/c mice and transformed mouse neuroblastoma cells and found that morphologically differentiated neurons appear in culture with characteristic spike potentials upon stimulation and that several neurotransmitter-related enzymes can be detected, though synaptosomes and synaptic transmission have not yet been demonstrated. The effects of serum, of protein synthesis inhibitors, and of the microtubule-protein-binding substance colchicine can be evaluated in culture. Cells seem to become highly differentiated only as they slow their rate of cell division. Acetylcholinesterase activity increases rapidly as neuronal processes appear, while catechol-*O*-methyltransferase and other enzymes do not share the same pattern of regulation. Since there is evidence for both norepinephrine and acetylcholine in these clonal cultures, it will be very interesting to learn whether a single neuron can produce only one or the other of these neurotransmitters when it becomes highly differentiated.

Specialized processes of differentiation in brain may be engrafted upon those common to other tissues, and environmental modification leads to complex behavioral phenotypes, particularly in man. Nevertheless, there was optimism that experimental approaches of the type discussed can unravel some of the mystery of gene action in the nervous system.

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