The LKB Ultrolab Diluter is one of the fastest and most accurate diluters on the market. It will siphon up a preset volume of a sample liquid and flush it out with a preset volume of a reagent at a rate of up to 1200 times an hour.

The Ultrolab Diluter can also be used as a dispenser, to dispense one or two reagents at the same high rate.

Each pump is permanently preset to deliver 10 different volumes, which can be selected by merely pressing a pushbutton. Three pumps are available to choose from, giving in all a choice of volumes from 10 μl to 3000 μl. These are high-precision pumps, with an accuracy of ±1% and a reproducibility of ±0.5%. Tight, leak-free operation is achieved by employing smooth, sapphire pump plungers.

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The PACER systems simply deliver far more solutions per day or per dollar than any alternative systems. Further, we help you zero in on optimum efficiency by offering three series of systems: PACER 500, PACER 600 and PACER 700. Each series offers three sets of options with a wide choice of peripherals. To let you choose a setup with capabilities matched almost precisely to the requirements of your problems or to your preference for input/output.

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For details on our whole PACER story, please write or call today.

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show you where you’ve made a mistake—so you can quickly correct anything from one character to an entire block of text with just a few quick strokes on the editing keys.

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**New Series 9800 Line Printer gives you fast formatted output.** If your work calls for formatted hard copy, you’ll be happy to know you no longer need suffer the tedium and noise of slow, mechanical output writers. Our new Series 9800/Model 66 Line Printer mounts atop your Model 30 to give you a fast output of 250 lines per minute. (That’s equivalent to typing 3,600 words per minute.)

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Operate throughout the speed range of 2,000 to 55,000 rpm (up to 150,000g).

Model RK
Refrigerated Ultracentrifuge

The Model RK Ultracentrifuge was designed for high g, continuous sample flow — either with density gradients or for pelleting. It utilizes a cylindrical rotor supported at either end by a hollow shaft and damper bearing. Fluids can be transmitted through the shafts in either direction to the rotor core or wall. An air turbine provides the driving force to the upper shaft with minimal heat transfer to the sample.

The static fluid lines are joined to the rotating shafts via a simple friction seal surrounded by a closed coolant system, eliminating aerosols and cross-leakage between in/out effluent lines. The result is a reliable seal for continuous flow up to 65 liters per hour throughout the entire speed range.

A variety of rotor configurations permit isopycnic banding, rate-zonal, pelleting, or fixed-angle tube separations.

The Model RK offers the highest available throughput and g forces for continuous flow operation. It is unequaled for the high-resolution concentration of cells and subcellular components from large quantities of fluids. Varying the speed and flow rate permits the separation of particles with sedimentation coefficients as low as 10.

The Model K, the production version of the RK, is used worldwide to manufacture over 80% of the annual supply of influenza vaccine.

All the major U.S. programs attempting to isolate and identify antibodies of cancer related antigens utilize an RK or K.

The design characteristics of both models stress reliability and simplify the bio-containment of hazardous substances. Their modular design permits the separation and containment of the drive and rotor unit from the control console. Worldwide installation, factory service, and leasing are available.

MODEL RK

THROUGHPUT: 60 liters/hr.

ROTOR CAPACITY: 12 tubes (100 mm)

GRAVITATIONAL FORCES: 80,000

MODEL K

THROUGHPUT: 90 liters/hr.

ROTOR CAPACITY: 12 tubes (100 mm)

GRAVITATIONAL FORCES: 100,000

Technique For Isolating Subcellular Particles
From Large Quantities Of Fluid

The simultaneous isolation and concentration of viruses from large quantities of cell culture fluids is accomplished by continuous flow with isopycnic banding. The procedure is very simple yet extremely effective. The density gradient is loaded into the rotor at rest (A). As the rotor is gradually accelerated, the gradient reorients itself vertically along the wall (B). Sample fluid is now pumped into the rotor at one end on a continuous flow basis (C). The sample particles sediment radially into the gradient of increasing density. They eventually band (isopycnically) in those cylindrical zones where the gradient density equals a particle's buoyant density (D). At the end of the run, the rotor is decelerated (E) and the gradient reorients to its original position without disturbing the particle bands (F). The banded particles are now ready to be unloaded with the rotor at rest. Fractions are collected (G) using air or water pressure and a small peristaltic pump to control flow.

SELECTED MODEL RK ROTORS

<table>
<thead>
<tr>
<th>ROTOR</th>
<th>ISOPYCNIC BANDING</th>
<th>RATE-ZONAL</th>
<th>LIPID PELLETING</th>
<th>MAXIMUM RPM</th>
<th>MAXIMUM DT</th>
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<td>RK 3</td>
<td>X</td>
<td>X</td>
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<td>RK 5</td>
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<td>X</td>
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<td>60</td>
<td>20</td>
</tr>
</tbody>
</table>

*All have 45,000 rpm pathlength fixed angle tubes. All rotors require a fluid cooling jacket.

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*Redrawn here for clarity. Multipoint original available on request.

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...and maximum absorption alternatives. To describe the “constant quality” projection as “his image of the normal educational condition” is a clear distortion.

Vaughan and Sjoberg attack my use of the word “normal” [for example, “In a normal year, approximately 50 percent of new doctorates take positions as college and university teachers” (J, p. 135)] to describe a steady trend, claiming that I “imply that it is fundamentally good.” Surely anticipating the continuation of a customary pattern of growth or market behavior does not have “normative” overtones. They take even greater liberties when they refer to my “assumptions concerning the ideal proportion of Ph.D.’s in colleges and an ideal student-teacher ratio of 20 to 1” (italics added). None of the one or two dozen economists and sociologists who have attempted to project trends in the academic labor market have ever assumed that likely events were therefore “ideal.” The incremental student-teacher ratio of 20 to 1 happens to be the average for the period from 1958 to 1972, and 44 percent of college faculty members happen to have the doctorate. It surely is not my conception of the ideal world; it is part of the real world that one must contend with.

Finally, in one of the few instances where I have stated a personal preference among public policy alternatives, Vaughan and Sjoberg claim that I fail “to recognize the political dysfunctions of . . . [my] rather elitist educational commitment.” “Implicit in the policy for restricting graduate programs is the notion that limited funds would be spent most expeditiously on those institutions wherein high quality is already judged to exist. By implication . . . this policy would lead to the support of a relatively small number of low-risk students who are carefully selected by these prestigious institutions.” I have argued, and firmly believe, that it is inappropriate federal policy to merely let the market resolve the problem, imposing a kind of Malthusian adjustment upon academic institutions. Instead, I have argued for a positive program of federal support of graduate education that would attempt to provide long-term financial stability for the major graduate schools. I have suggested that “75 to 100 national universities” should receive basic federal support, but I hardly see that as being elitist. These same universities today produce 75 to 80 per...
cent of all the doctorates, and most of them have enviable records in recent years of enrolling minority students. One could hardly characterize the nearly quarter of a million graduate students enrolled in these universities a “small number of low risk students.” Vaughan and Sjoberg create straw-man arguments that mislead the reader.

In summary, it is difficult to know what Vaughan and Sjoberg are positively recommending. They applaud the actions of institutions and government agencies in cutting back on enrollments, yet deplore my proposal for added federal aid to support the major graduate centers. They wax enthusiastic about educators taking “a more active role in defining the future social order” and “creating a more viable and meaningful way of life,” but they provide few hints as to what that new order might be. They want graduate education to change markedly in undefined ways to better serve some future undefined society. I wish they would reveal that vision to their readers; many of us might share it.

ALLAN M. CARTTER
Carnegie Commission on Higher Education, 1947 Center Street.
Berkeley, California 94704

References

Although many of Cartter’s comments reflect the pique of one personally offended, his response nevertheless is instructive: it more fully exposes his basic orientation to public scrutiny. We shall consider the more obvious areas of intellectual friction and, at Cartter’s behest, outline our vision of the future.

1) A fundamental source of disagreement between Cartter and ourselves arises from our differing conceptions of the nature of the market. Cartter’s central argument regarding the academic labor market rests on the premise that market outcomes necessarily result from invariant, impersonal forces. In our view, market operations are less determinate; outcomes emerge from choices among a range of alternatives partially defined by noneconomic fac-

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 tors. For one thing, the market has a political component.

Only by taking the existing power structure as a given can Cartter argue that educational needs are reflected in market demands. What is required by the broader society and what some persons in positions of power are willing to pay for are not necessarily the same. To equate social needs with effective market demand is to cling to a 19th-century definition of the market. To speak of a surplus of highly educated talent in a highly affluent society, where about 12 percent of the population over 25 has completed four or more years of college, is to denigrate the value and importance of higher education (7).

2) Cartter's conception of market operations leads him to accept long- or moderate-range social projections uncritically even though most social scientists have expressed major reservations about them. He resists the suggestion that some projections are realized because they are a case of self-fulfilling prophecy.

By asserting that "Galileo may or may not have preferred the earth to be round, but the protestations of the bishops did not alter the facts," Cartter would have us believe he studies invariant market forces much as a natural scientist would investigate his subject matter. But Cartter's reasoning is as faulty as his example. Galileo was persecuted not for arguing that the earth was round but for actively supporting the Copernican heliocentric theory. Nor are Cartter's projections and analysis of the market comparable with Galileo's experiments or his telescopic observations. Then too, Cartter, by his own admission, acted as adviser to the New York State Commissioner of Education and thereby influenced the nature of the academic labor market. Church leaders who censured Galileo did not exert a similar influence over the laws of nature. Cartter often seems to don the robes of a "cleric" who attempts to keep the academic labor market in line with a particular political orientation.

Does Cartter seriously believe that the reputed Ph.D. surplus and the operation of narrow economic forces are alone responsible for the precipitous decline in the number of federally supported graduate students "from 51,446 during fiscal year 1969 to 22,121 estimated for fiscal 1972" (2)? Surely political decisions on the part of the Nixon Administration have affected these developments.
More generally Cartter fails to recognize that the social researcher is a variable in the research process, and he seems unaware of Robert K. Merton’s analysis of the self-fulfilling prophecy. By acting in terms of his own projections, and encouraging others to do likewise, Cartter is then better able to claim that his projections are being fulfilled.

Cartter to the contrary, we do not applaud the cutbacks in graduate programs or in graduate students. We discussed the present cutbacks in order to illustrate Cartter’s contribution to a self-fulfilling prophecy. Our position is that major readjustments in the training, and hence in the kinds, of Ph.D.’s are required, and if some constraints on the market are overcome by purposive action and future possibilities realized, then higher education would expand rather than contract.

3) Cartter’s rebuttal confirms our assertion that he fails to recognize the necessity for placing his projections of academic manpower within the context of broader sociocultural trends. He suggests, for instance, that the notion of a “postindustrial society” is a cliché. Cartter thereby ridicules the concerns of many eminent social scientists, such as Daniel Bell (3), as dealing with trivial nonissues. Although Bell, like Cartter, is locked into the categories of the present in projecting or predicting future events, Bell’s discussion of the postindustrial order has highlighted fundamental structural changes, especially in the labor force, that have been occurring in American society. According to Cartter the trend toward a service economy has been underway since the turn of the century and therefore is not new. The implicit hypothesis that the growth of the service economy during the past two decades is similar to that during the first few decades of the 20th century, when America was moving from a rural- to an urban-manufacturing base, is demonstrably false.

Cartter reasons that examining sociocultural trends “does not really advance the argument” over the future need for Ph.D.’s. By implication, only the more readily quantifiable aspects of society—for example, selected demographic and economic phenomena—are worthy of special attention. This reasoning leads Cartter to accept only variables defined in official statistics as affecting the academic marketplace. Yet official statistics are constructed in terms of past and present social definitions, and officials generally ignore countervailing trends which, though often qualitative in nature, can readily, when viewed in their cumulative effects, undermine such projections as Cartter’s.

4) The future is not a fact; it must be created by taking into account not only the constraints Cartter stresses but the possibilities he ignores. Our vision of higher education in the future, calling for its expansion, seeks to contend with complementary and contradictory forces. First, it is necessary to provide ever-expanding technical knowledge and skills for many sectors of the populace. The use of higher education to upgrade the knowledge and skills of such occupational groups as secretaries and policemen is illustrative of what can be done in such sectors. We also called attention to the possible upgrading of the skills of many college instructors. And new occupations, based upon increased scientific knowledge, must be created to cope with, for example, environmental concerns.

Moreover, Cartter should recognize the need as well as the potential for far more highly trained personnel in, say, the health services, and to be more specific, in the field of geriatrics. But educators must participate in redefining the social and economic rewards of such activities so that people will find greater satisfaction in service to humanity.

Second, we are far more concerned with the issue of the quality of life than is Cartter. He fails to acknowledge the equality movement in American society. He seems unaware of the grave difficulties that the lower-middle class, ethnic minorities, and women will experience if educators and political officials act according to his projections. Cartter persists in slighting the potential contributions of women to higher education and the broader society.

Equality can be approached only if we restructure higher education and if some income redistribution is achieved. Even so, expansion of higher education is essential. To attain relative equality through “compensatory justice,” which favors the underprivileged at the expense of those immediately above, that is, the lower-middle class, can only intensify the current backlash against higher education.

We must also recognize that higher education can become leisure, leisure in Aristotelian terms as contemplative thought. Americans expend huge sums on entertainment and leisure-time activities. But higher education has come...
to be viewed by many persons, whether members of the alternative society or other adults, as a laborious set of requirements that have to be met in order to acquire a job. A redefinition of education as leisure cannot be attained through commitment to present-day bureaucratized educational structures and the concomitant “efficiency model.”

An elaboration of our image of the future of education must await another essay. However, our discussion has emphasized Cartter’s call for a retrenchment in higher education, whereas we, though cognizant of constraining forces, deem its expansion essential if American society is to cope with accelerated social change. We must broaden the social and economic base of the college population and aggressively create multifaceted programs in higher education for use by persons throughout their adult years.

TED R. VAUGHAN
Department of Sociology,
University of Missouri, Columbia 65201

GIDEON SJOBERG
Department of Sociology,
University of Texas, Austin 78712

References and Notes
3. Bell has written extensively on this topic. See, for example, D. Bell, Dissent 19, 163 (1972); Survey 16, 1 (1971).

Medical School Admissions

Samuel Z. Goldhaber’s report “Medical school admissions: A raw deal for applicants” (News and Comment, 28 July 1972, p. 332) is a classic in its field and hopefully will prompt the needed reforms. However, I must caution that Goldhaber’s suggested improvement in the admissions process of reducing or eliminating state preference regretfully will never be changed. The money which the federal government provides to most state medical schools is small in comparison to the state funds provided. Consequently, as long as the legislators control the purse strings, a majority of the entering class will be state residents. It would be interesting to compare statistics on the number of state residents educated in a state medical school who eventually practice medicine in that state versus the number of out-of-state students educated in the same school who set up practice in that “foreign” state. Legisla-
tors would be amazed at the results. The influence of specific state politics within the medical educational system is too deep to be uprooted now.

RICHARD D. PEPPLER
Departments of Anatomy and Obstetrics and Gynecology, Louisiana State University Medical Center, New Orleans 70112.

Goldhaber did a very good job of summarizing the very real problems that face those applying to medical school today. The data speak for themselves, and certainly explain the anxieties and stresses which face those who would pursue a course in medicine.

Having spent a good many years in medical school administration, a number of those as chairman of the admissions committee at a so-called competitive medical school, I am fully aware that a situation that has been relatively difficult since the end of World War II has become progressively so in recent years.

Goldhaber's call for "... a more equitable system of medical school admissions ..." is all to the good. He is, however, rather naive in asking medical schools to "... weigh more heavily applicants' motivation for applying to medical school and their personal attributes, such as compassion and general intelligence ..." It would be wonderful if we knew how to do these things, but to date I am rather unaware of any satisfactory way of measuring motivation. I have discussed this problem with knowledgeable colleagues in the field of psychology, and have never found any of them who believed that motivation could be measured accurately. Further, I don't remember ever interviewing a medical school applicant —and I interviewed hundreds—who ever seemed anything but well motivated. Similarly, no one would deny that compassion and general intelligence are very important qualifications for a would-be physician. I am afraid, however, that finding a way to determine objectively whether an individual is compassionate or not, particularly during the relatively brief time that medical schools have for evaluating candidates, poses an almost insuperable task.

I don't suggest we shouldn't keep trying to do a better job in our evaluation. Goldhaber is right in saying we need a better system, but how to get it is something else again.

ROBERT J. GLASER
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This book is a comprehensive one, covering a broad spectrum of fundamental aspects of diffusion and point defect properties. It is also quite an impressive one in the depth that the author can manage in treating such a broad range of subject matter. For example, there is a fine chapter on the electronic states of point defects and, in the other domain of diffusion phenomena, an equally comprehensive treatment of the precipitation problem. It is perhaps not unusual to see such a variety of topics discussed by different experts in a conference proceedings, but to find them systematically developed by one author is not common.

This book first shows the fundamental aspects of the equilibrium point defects and how the vibrational and electronic properties of the crystal change as a result of interaction with the defects. After the author has established the basic properties of point defects, he considers their diffusional behavior under different driving forces in various types of crystals. The characteristics of point defects in the four main classes of crystals, molecular, ionic, valence, and metallic, occupy the last part of the book. The author approaches the subject usually by a qualitative discussion of the physics involved, then proceeds to formulate the problem in detail. Considerable effort has been spent in showing the details of many mathematical derivations in the book. It appears to be the intention of the author that this book be used as an advanced level textbook. It should serve this purpose very well. Graduate students after completing the first one or two years’ courses in physics or some related field should not encounter difficulties in understanding the material, and they will probably find this book a useful stepping-stone to the research field of point defects.

Some outstanding problems of current research interest have been included, among them the question of the validity of using the reaction rate theory to treat the details of the atomic jumping process, particularly the isotope effect; the dynamical theory of diffusion and the quantum effect of light interstitials in diffusion; the dielectric screening of impurity atoms in metallic and valence crystals; and the use of magnetic and optical resonance techniques to measure defect properties. These topics, of particular interest to the author, are explored to considerable depth. Researchers currently investigating diffusion and point defects would find the book very useful indeed.

Paul S. Ho
IBM Watson Research Center, Yorktown Heights, New York

Books Received


