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Beckman INSTRUMENTS, INC. SPINCO DIVISION
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INDEX TO VOLUME 153

Yoshida, M., and H. Ohtsuki: Compound ocellus of a starfish: its function, 197
Yougara, W., et al., Treatise on irreversible and statistical thermophysics, book review of, 1630
Young, A. P.: Nickel orthouronate: high-pressure synthesis, 1380
Young, M. D., et al.: Plasmodium vivax transmitted from man to monkey to man, 1006
Young, T. C., Jr., and P. E. L. Smith: Research in the prehistory of central western Iran, 386

Zanchetti, A. See Guzii, M., et al.
Zapolsky, H. S.: Doppler interpretation of quasar red shifts, 635
Zeiger, M. (News and Comment): Information services, 722
Zhulin, V. M., et al.: Acrylonitrile polymerization in a miniaturized high-pressure optical cell, 649
Zin, I. Y. Z., et al., Chains of particles in shear flow, 1405
Zimmerman, H. E.: Interpretation of some organic photochemistry, 837

Zinc and cobalt: effect on the iron metabolism of Ustilago sphaerogena, H. Komai and J. B. Neilands, 751
Zisk, S. H.: Brightness distributions of radio sources at 2-centimeter wavelength, 1107
Zobel, C. R. See Berger, J. E., et al.
Zohary, D. See Harlan, J. R.
Zwicky, F.: Pygmy stars: first pair, 53
Show-Stoppers!

The new Beckman CPM-100™ and DPM-100™ Liquid Scintillation Systems literally stopped the show at a recent scientific meeting. And for good reason. These new systems electronically compute data and provide readout in CPM, DPM, or quench-corrected DPM with 2 sigma % error. And of equal significance, they now make it possible to achieve uncompromised performance and data quality from a room-temperature system with 100-sample capacity.

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For more information on these advanced liquid scintillation counters, contact your Beckman Sales Representative today about a demonstration, or write for Data File LLS-266-Sp.

†Prices are stated in U.S. funds and are subject to change without notice.
An assemblage of experts doing research in low-level counting techniques needed (but could not find) instruments that met their exacting requirements. So, as you just might surmise, they solved their problems over the years by developing several rather distinctive low-level counters—not to develop instrumentation for the sake of developing instrumentation (or even for the sake of selling it), but only as functional, reliable means to ends. And then, inevitably, as they used this equipment in their own research programs, they de-bugged it. Result: user-designed, user-perfected, user-seasoned, low-level counters which can do what no existing instruments can do. Now as other workers see these counters working in our laboratories, we get, with increasing frequency, requests for duplicate copies. Accordingly, we are now making these counters available (not reluctantly, it should be noted) to others with similarly exacting requirements. For the specifics, read on.

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The Model 855 Triton, more sensitive than its progenitor above, is ideal where the measurement of extremely small amounts of gaseous radioactive contamination is a necessity. This instrument is particularly suited for monitoring the maximum permissible concentration of tritium in air (5 μC/M³) since the sensitivity is 10 μC/M³ full scale. It can also serve to measure other beta emitters and is a very sensitive gamma area monitor too (.05 mr/hr. full scale). Ask for bulletin 855 for complete data.
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810

SCIENCE, VOL. 153
MEETING • 26-31 DECEMBER

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The hotel sleeping accommodations are for your convenience in making your room reservation in Washington. Please use the coupon below and send it directly to the AAAS Housing Bureau in Washington. Give a definite date and estimated hour of arrival, and also your probable date of departure. The Housing Bureau will make the assignment and promptly send you a confirmation.

For more details on all of the above facilities and services, and for a list of the headquarters of each participating society and section, see the 22 July issue of Science, page 437.

### HOTEL RATES* (Per Day)

<table>
<thead>
<tr>
<th>Hotel</th>
<th>Single**</th>
<th>Double</th>
<th>Twin</th>
<th>Suites†</th>
<th>Parking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheraton-Park (1260)</td>
<td>$12-14</td>
<td>$16-18</td>
<td>$16-18</td>
<td>$30</td>
<td>Free for registered guests</td>
</tr>
<tr>
<td>Motor Inn (214)</td>
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<td>Free for registered guests</td>
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<tr>
<td>Shoreham (900)</td>
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<td>16-18</td>
<td>35</td>
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<tr>
<td>Motor Inn (100)</td>
<td>15</td>
<td>19</td>
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<td>Free for registered guests</td>
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<tr>
<td>Washington Hilton (1200)</td>
<td>14-16</td>
<td>18-20</td>
<td>18-20</td>
<td>50-75</td>
<td>$2</td>
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†One-bedroom parlor suites; rates for larger suites available upon request.
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19 AUGUST 1966
Picker Nuclear has an exceptionally diverse line of instruments for radio-tracer studies of every kind. But the special news here is this: the line has now been expanded to include the well-respected ANSITRON liquid scintillation counter for beta work, and a unique flow monitor system for liquid or gas streams. These instruments are now available only from Picker Nuclear. And Picker Nuclear will service them—as it will every ANSITRON instrument sold previously in the United States and Canada.

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The ANSITRON is clearly the unit of choice when the goal is maximum simplicity in beta counting. One example (of several): the availability of “β-Set” plug-in discriminators which provide preset control settings for commonly used isotopes and mixtures. When inserted, these “β-Set” modules automatically set upper and lower discriminator levels. This assures precise duplication of settings for repetitive experiments and effectively eliminates a source of human error. Other design features include: logarithmic spectrum shaping, cpm computation and automatic external standardization. (With Picker service everywhere.)

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**The Scinti/Flow monitor system**
This unique system permits the continuous assay of beta radiation in flowing gas or liquid streams. And it is not limited to aqueous solutions: materials in organic solvent systems can be continuously monitored. Other features: cross contribution subtraction provides virtually complete dual isotope separation; external standard enables quenching evaluation; logarithmic amplification simplifies control operation; compact design requires minimum laboratory space. And now too, Picker service everywhere.
Weaver is overly optimistic in his opinion that "the only useful judgment concerning university teachers comes from their immediate working colleagues."

It is very likely that no teacher is the best possible one for all his students and that no teacher is totally ineffective for all the students he teaches. Between these extremes, however, it should be possible to devise a comprehensive scheme of evaluation that can be accepted ultimately by a reasonable proportion of those interested in developing such a measure. . . . I would give greater weight than Weaver to students' judgments.

LEVON KABASAKALIAN
65 Sun Haven Drive,
New Rochelle, New York 10801

. . . It seems fruitless to discuss sources of evaluating teachers without establishing criteria for judging a good teacher. Having taught at various levels for 22 years, I am convinced that there are four basic criteria for good teachers.

1) Competence in subject field. A good teacher should be proficient not only in the subject matter he teaches, but also in related subjects, regarding teaching not as a routine duty but as a challenge requiring constant revitalization. He must be alert and diligent in searching both old and new knowledge.

2) Clarity of verbal communication. Instructions must be presented in such a way that the majority of students in the class comprehend and respond. Scholars with difficulty in verbal presentation can be great masters for a few graduate students though they may not be good teachers for most undergraduates. A seriously devoted teacher can improve his deficiencies in verbal communication.

3) Dedication to the educating process. The genuinely dedicated teacher recognizes that good teaching inspires results which sometimes don't become apparent for years, even decades, yet he finds such long-range opportunities continually challenging.

4) Love for students. Disinterest in one's pupils is not characteristic of good teachers who realize that their concern for individual students is an essential of teaching and the cultivation of wholesome citizens. Even in large classes, frequent contacts should be arranged to emphasize the personal relationship between teacher and students.

In summary, the first two criteria are objective and can be learned by any devoted teachers; the last two are subjective and must be acquired by self-discipline. Only when a teacher meets these criteria to a marked degree can he then be considered a good teacher.

JOSEPH C. LEE
Department of Anatomy, School of Medicine, State University of New York at Buffalo, Buffalo 14214

The First Computers

Luther Carter, in his article on "Campus computers" (News and Comment, 25 Feb., p. 969), repeats a common error about the early history of computers, in saying that "the first computers were conceived and built at universities."

In the present context, I assume the term "computer" refers to the typical modern computer which differs from those of an older vintage in several ways. Probably the outstanding differences are in the programmed control and in the use of fast binary components.

In point of fact, there were in daily operation several computers with these characteristics some years prior to any completed in a university. The use of binary logic (with the excess-three code, now familiar to computer technology) was introduced in a computer designed by me and built at the Bell Telephone Laboratories in the period 1937–1939. It was demonstrated by remote control from Hanover, New Hampshire, at a meeting of the Mathematical Society in September 1940. . . .

The first operating computer in a university might be said to be the Harvard Mark I, of 1944. This machine was a decimal rather than a binary device and employed IBM mechanical drum accumulators. The first university-originated binary computers would, I think, be the Mark II and the ENIAC, both of about 1946. . . . I should mention, too, that Konrad Zuse in Germany also made use of binary elements prior to the university-originated computers.

Perhaps, in view of the work of many pioneers like Aiken, Mauchly, Eckert, Williams, Andrews, Booth, and hundreds of others, it is unfair to name any particular computer as "first," but in recognition of the con-
The facts have changed!

Three new pre-coated systems for Thin Layer Chromatography have lowered cost, raised quality, widened its application.

**New facts about pre-coated glass**

The new E. Merck, A. G. (Darmstadt) Pre-Coated Glass Plate is the finest, most versatile pre-coated TLC system ever developed. Yet a 20x20 cm plate costs as little as 68c (in quantity) — about half as much as previously available glass systems. And it offers 5 notable advantages:

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- unique organic binder — may be used with corrosive sprays (including sulphuric and perchloric acids) and charring techniques — cannot be eluted by organic solvents — does not interfere with stains

**New facts about plastic foils**

Although it is the most elegant TLC system in existence, use of the pre-coated plastic foil has been extremely limited due to its relatively high cost and narrow range of applications. Now Brinkmann introduces the MN Polygram pre-coated foil, far more versatile but costing about 30% less.

The MN Polygram foil features a dry layer with significantly higher capacity than that of previously available coated foils.

Four different types of coating are available: silica gel with starch binder, silica gel with starch binder and fluorescent indicator, cellulose powder without binder, and cellulose powder without binder but with fluorescent indicator. Each type comes in both 20x20 and 5x20 cm sizes.

Where a binder is used, starch has been selected because previously used binders (such as polyvinyl alcohol) have a substantial negative effect on the adsorption characteristics, especially when non-polar solvents are employed. Starch, however, is normally satisfactory except with highly aqueous systems, in which case the foils must be handled with care.

**The Chromatotube — a new fact in itself**

Chromatotubes are round glass tubes (12.5x2.5 cm) coated with sorbent on the inside. Since one end is closed, they are also self-contained developing tanks. After spotting, the open end is immersed in an auxiliary solvent tube sealed to the side by a plastic ring.

Special binders are not required and all conventional solvents and staining reagents may be employed. After separation, the tube can be eluted overnight and reused after activation.

Providing the most reliable, reproducible Rf values, Chromatotubes are probably the best TLC system for maintenance of uniform standards. The developing distance of 10 cm is marked so that the RF is read at a glance. Thus the Chromatotube is ideal for mass analyses as in production control, clinical testing, and teaching procedures involving numerous students. At a relatively low cost each student has a complete chromatographic assembly.

Two types are available: Series AT tubes have been activated for 30 minutes at 110°C and subsequently sealed against external moisture; Series IT tubes are air dried and can be activated according to individual requirements.

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Please send me the following literature:
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Industry Does Retrieve Information

Fry has presented an interesting mathematical expression for the relationships of information and research (Letters, 24 June). He states: “It often takes less time to do it all over again than to find out how someone did it earlier. This is, in fact, common practice in industrial research...” This is far from the case in the pharmaceutical industry. The economic consequence of spending millions of dollars on a new product, only to learn that it is unpatentable because of the existence of prior art, would be so disastrous that no research group in their right minds would knowingly take such risks. In fact, we devote considerable time and expert attention to literature searching and, from personal experience in both academic and industrial spheres, I would say that the literature is searched more broadly and in greater depth in industry than in the academic world.

In part the difference in searching efficiency in industry is due to the large files that can be searched by computer, particularly in the patent area. Any deficiencies in our literature searching performance are certainly not due to lack of trying.

Maxwell Gordon
Smith Kline & French Laboratories, Philadelphia, Pennsylvania

New Channels for Grants

Recent discussions about the merits of project research grants over institutional grants have failed to mention one remedy that would overcome the disadvantages of institutional grants. As Gross points out (Letters, 6 May), senior administrators of institutional grants are tempted to divert most of the awarded funds to projects which happen to interest them. Though usually retired from active investigation, they continue naturally to have their favorite ideas about what is important to investigate. They are, moreover, under other pressures to build up this or that department or project in order to please or appease critics of their institutions.

The remedy which I propose resembles a water irrigation system. In such a system, each sluice gate diverts water while allowing other water to pass on to a lower level. In application of this principle, let us imagine agency A capable of disposing of so many funds for research. Suppose that this agency divides its funds into two portions. One portion will continue to support project grants directly applied for by the individual investigators or teams; the other will be awarded to institutions directly. Institution X (for example, a School of Engineering or Medicine), then receives a substantial grant as its share of the funds devoted to institutional grants. Of this institutional grant, the dean (and his associated committee, if he has one), can retain half, but must pass on the other half to the chairman of the different departments of the benefited school. The chairmen in turn can use half of what they receive, as they see fit, but again must disperse the other half to any applying investigator within the department. If a chairman found no individual applicant within his department, these funds would revert to the next higher level, the dean’s committee. This would stimulate the chairman to find and appoint applicants likely to use the funds.

A method such as this would assure original individual investigators of some support in spite of opposition from senior committee members of the institution. At the same time, it would preserve the privileges and responsibilities of administrators in retaining control of major portions of funds. We all know the familiar predicament of original investigators whose applications for funds have been frustrated for years both by local committees at their institutions and national committees of fund-granting agencies. The local committees are usually composed of persons outside the investigator’s specialty who are not in a position to judge the value of an investigator’s project or his abilities. But the outside committee, composed of scientists in the same field, often include many persons who have drifted out of active investigation themselves, while enjoying committee life. These persons often have clear ideas of where the next advances in their fields will come from and may prove equally frustrating to the origi-
nal investigator when he applies for funds. Such a man needs some protection from the general conservatism of all committees. At the same time, the taxpayers or other fund-givers are entitled to some protection against waste and wildness, which protection could be provided by allowing administrators to retain control over some, but not all, the funds passing through their hands.

IAN STEVENSON
Department of Psychiatry, University of Virginia School of Medicine, Charlottesville 22901

On Using Inferential Statistics

Statistical tools are of two general kinds: descriptive and inferential. The first type describes the investigator’s findings, summarizing raw data into more comprehensible form—numerical, graphic, or tabular. The second type aids the drawing of conclusions as based on the rules of probability.

Findings may be the result of chance fluctuations. An investigator contributes more when he indicates the degree of confidence he has that his data are not the result of chance factors. The use of inferential statistics specifies precisely this degree of confidence. In addition, readers are helped immensely when data are presented clearly. The appropriate use of inferential concepts frequently clarifies data presentation as well as legitimate conclusions.

In the 22 April issue of Science there were 23 reports. Of these, only four used inferential statistics. In two of these four, no statistically significant findings were reported. In a third report, over 20 statistical tests were performed but only one was significant, and this one was relatively unimportant, since the main findings of the authors (Greenberg, Atkins, and Schiffer) was the lack of significant difference in the measures of various bodily regions.

Perhaps the more critical observation is the following: of the 23 reports, 13 could have used inferential statistics—only four did. How “significant” these observations are is a matter for the reader to judge.

GERALD J. DRIESSEN
ARTHUR J. DERBYSHIRE
Department of Otolaryngology, Illinois Eye and Ear Infirmary, University of Illinois at the Medical Center, Chicago, Illinois 60612

Canalco’s 3x scale expansion is one of four major sensitivity-building features exclusive to Canalco’s Wide-Track UV flow analyzers. Available with manual or fully automatic switching, it gives you your choice of 0-100% or 67-100% Transmittance ranges on a chart grid a full 7½ inches wide. Expanded scale is equivalent to 0-0.17 O.D.; the nearest competitor has 0-0.25 O.D. on a 5-inch chart, and most others have no expansion at all. With automatic expansion (only Canalco has it!) you have greatest sensitivity when you need it, yet the pen never runs off scale for strongly absorbing eluates.

Only Canalco gives you a choice of flow cuvette path lengths up to 20mm (no others have more than 10mm, some have only 5mm), further boosting sensitivity over competitors. Canalco’s linear Transmittance recording gives the Wide-Tracks double the pen deflection of linear Absorbance instruments for weakly absorbing fractions.

It all boils down to this: The Wide-Track’s recording pen moves 3 to 20 times farther for nucleotides, from 2.7 to 6 times farther for proteins, than all competitors!

Added benefits: Canalco Wide-Track flow analyzers are available in either single beam or double beam (the latter especially useful for automatic baseline compensation in gradient elutions). Both single and double beam instruments have two photodetectors and true ratio circuitry to compensate for changes in source brightness. Modular design lets you use either a single beam or double beam sensing head with any Wide-Track recorder. Automatic scale expansion can be added to a manual instrument at any time. Wide-Tracks mate perfectly, of course, with Canalco Fraction Collectors (or anyone else’s).

A revealing comparison sheet has been prepared to show the performance of Canalco’s Wide-Tracks. It contains full-size chart reproductions that pit the Wide-Tracks against eight of the most popular competitors, for proteins and for nucleotides. If you’re planning the purchase of an ultraviolet flow analyzer, write us now for a copy of the Ultraviolet Flow Analyzer Comparison Chart. You’ll find it a real eye-opener!
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Temperature control from 0 to 50°C, with ± .04°C. accuracy for stationary incubation: flasks, bottles, test tube racks, etc., or flasks or vessels may be shaken — both the rate (75 to 150 oscillations per minute) and the amplitude (0 to 5 cm.) are continuously variable.

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ponents of seawater by F. Culking is fol-
lowed by a discussion of the minor ele-
ments by E. D. Goldberg. The dis-
solved gases are treated by F. A. Richards, with a separate chapter on
carbon dioxide by G. Skirrow. The nu-
trients, phosphorous, nitrogen, and sil-
icon, are discussed in separate chap-
ters by F. A. J. Armstrong and R. F.
Vaccaro. The dissolved organic consti-
ituents are discussed by E. K. Duursma,
and the production of organic matter in
the primary stages of the marine food
chain is described by J. D. H. Strickland.
The final chapter presents a more inte-
grated approach to the problem of anoxic basins and fjords by F. A. Richards.

Although the organization of the book makes it satisfactory as a refer-
ence work, it is inadequate as a text-
book. It fails to show the relationships
among the various chemical-physical and
biological factors. To train earth
scientists to cope with the problems
presented by nature, a textbook must
be better integrated, for the oceans are
ignorant of the narrow specialties sug-
gested by the chapter headings. The
book is useful as a series of review
articles by experts with an extensive,
relatively up-to-date bibliography and a
good index.

PETER K. WEYL
Department of Oceanography,
Oregon State University, Corvallis

Thinkers Incorporated

Bruce L. R. Smith's The RAND
Corporation (Harvard University Press,
Cambridge, 1966. 348 pp. $7.95) is
based on a thesis written at Harvard
and suffers to some extent from the
normal problems of thesis style. But
it affords us a welcome, comprehen-
sive study covering the history of
RAND up to about 1962. It describes
RAND's fortunate beginnings, the roles
of important individuals, and the
internal organization of the company,
and details the effect that one spectac-
ularly successful study (R-266, on de-
ployment and dispersal of air bases)
had on Air Force policy. In addition,
it deals with significant issues that have
been raised about nonprofit advisory
 corporations: the relationships to the
sponsor and to the public, and the
problems of competition (real or im-
agined) with industry and the univer-
sities.

But perhaps the most interesting
part of the book deals with the prob-
lems and prospects of the corporation.
There are discussions of optimum size,
of the mechanisms of getting individu-
als of great ability to work on inter-
disciplinary issues, and, perhaps most
surprising, the importance of "selling"
the results of its work, in depth and
detail, to the group that is paying for
them.

Smith obviously believes in the
 corporation's future (he now works at
RAND), but the problems he defines
and the future he paints make it ap-
pear that to some extent the good old
days are over and that RAND is a vic-
tim of its own success. And what a
success it was! The revolution of
strategic thinking in the United States
in the 1950's is clearly one of the
important RAND accomplishments.
The early thinking on missiles and
space, the use of quantitative social
science, and the development of pro-
gram budgeting deserve additional lau-
rels. One of the consequences of recog-
nition has been that universities which
once scorned strategic thinking as a
discipline hired away RAND people,
and the Defense Department took oth-
ers—Charles Hitch, Alain Enthoven,
Henry Rowen—to put the new brand
of thinking into effect within its own
walls. Because RAND was set up ini-
tially in the interests of the Air Force,
it was affected by the later decline in
relative importance and affluence of
the Air Force. RAND took on other
jobs, and new companies similar to it
began attracting some of the spot-
light.

One of the issues in government
agencies that are trying to develop
new programs is whether or not a
RAND-type corporation should be set
up to do independent advisory work
for them. Surely, the argument goes,
we need analytical help, and the al-
ternatives of short-term contracts with
industry or universities, or in-house
operation, seem to have great drawbacks.
Therefore, the history of RAND, the
most successful corporation of its kind,
has many lessons. But whether or not
such an organization would be useful
in studying transportation, pollution,
crime, urban development, or science
policy, is not clear. Revolutions of the
RAND type do not occur often. The
main lesson of this book seems to be
that RAND was a happy accident, very
dependent on the quality of its staff.

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