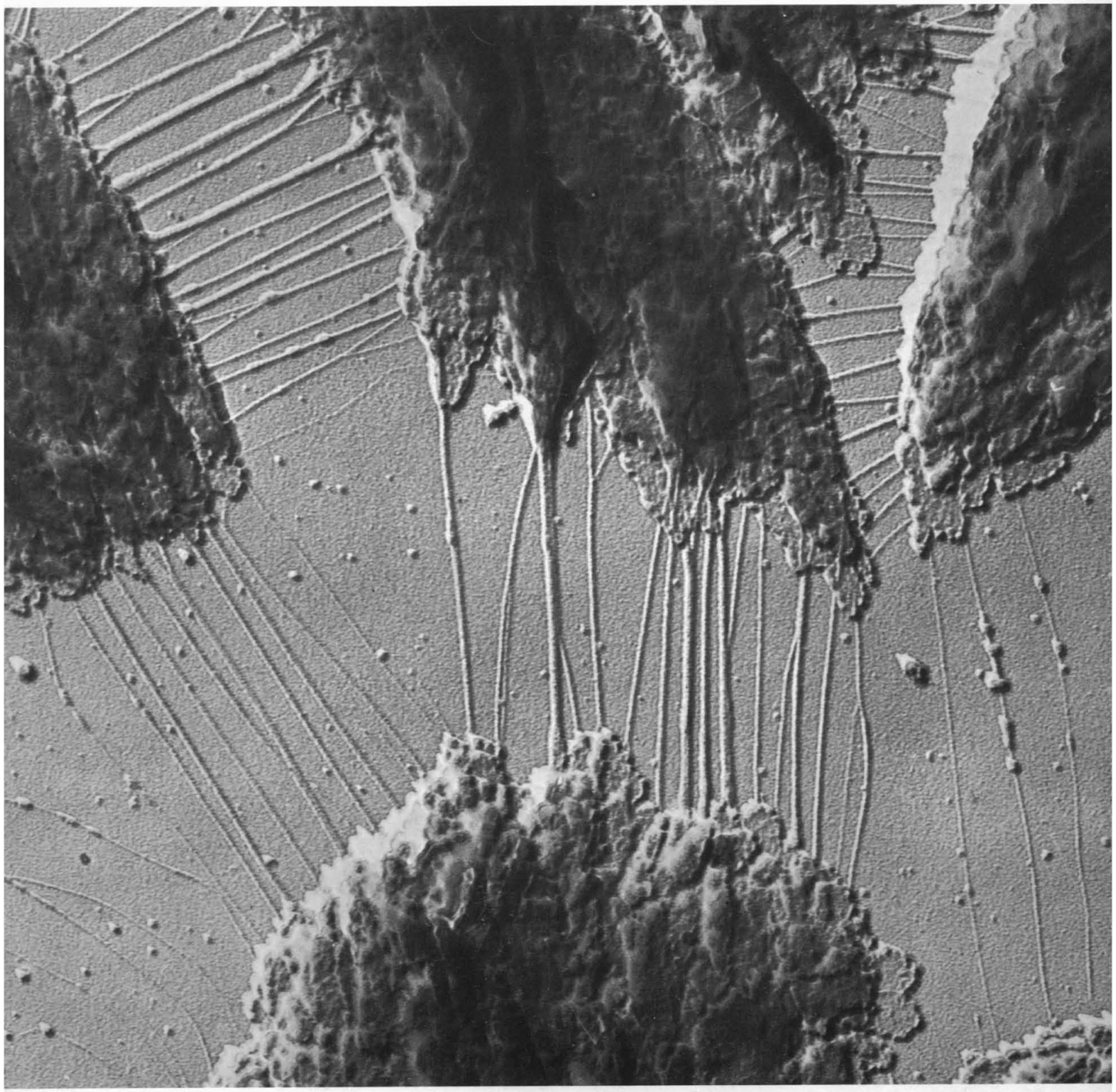
SCIENCE 19 November 1965
Vol. 150, No. 3699

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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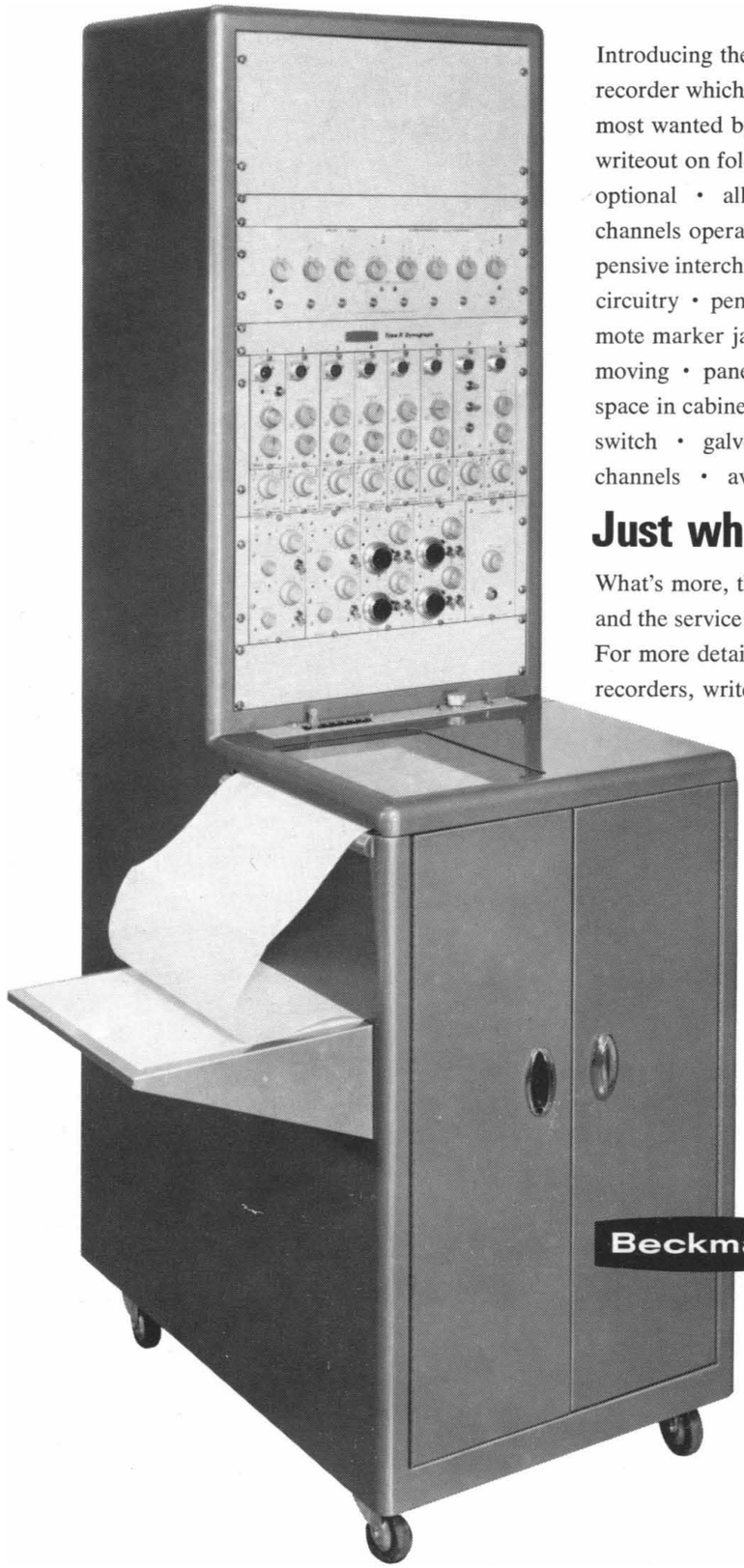

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19 November 1965
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SCIENCE

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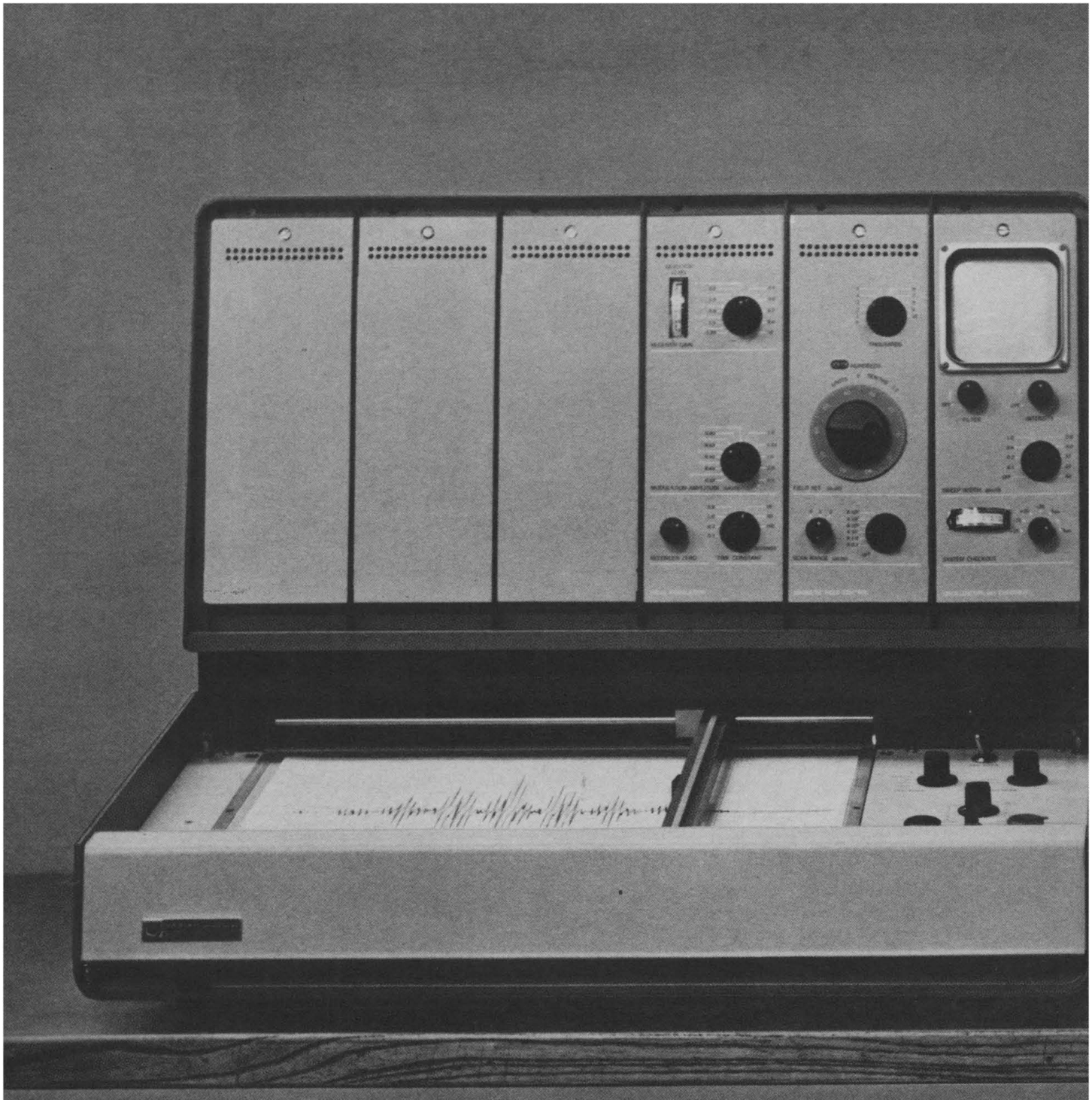
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

The mechanical properties of high polymers crystallized from a melt depend largely upon the nature of the connecting material between thin, ribbon-like crystals. The transmission electron micrograph, shadow-cast at 23 degrees, shows fibrous links between aggregates of crystals in a thin film of polyethylene (about × 65,000). See page 1026.



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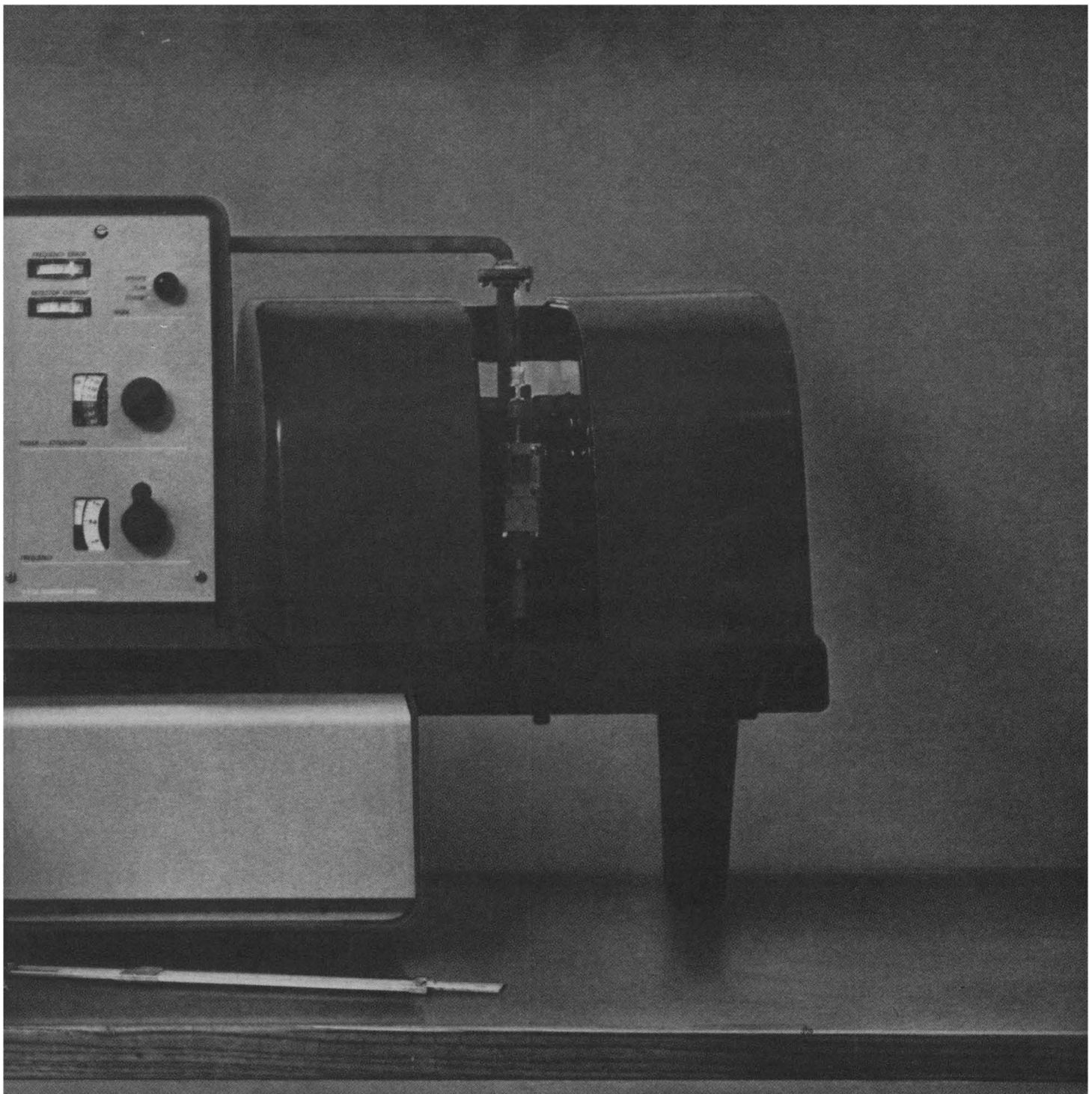

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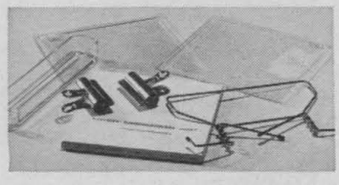
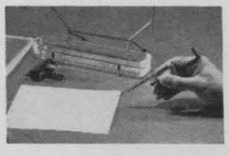
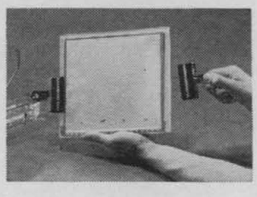
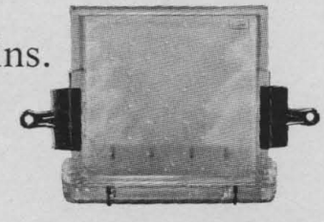
The EASTMAN CHROMAGRAM System for thin-layer chromatography consists of EASTMAN CHROMAGRAM Sheet and EASTMAN CHROMAGRAM Developing Apparatus.  It makes TLC—once messy and cumbersome—fast, neat, and uncomplicated. Gone are the bulk and expense of coating equipment and the problems of breakage and siliceous dust. You take EASTMAN CHROMAGRAM Sheet out of a box, spot it,  place it in the EASTMAN CHROMAGRAM Developing Apparatus,  and separation begins. 

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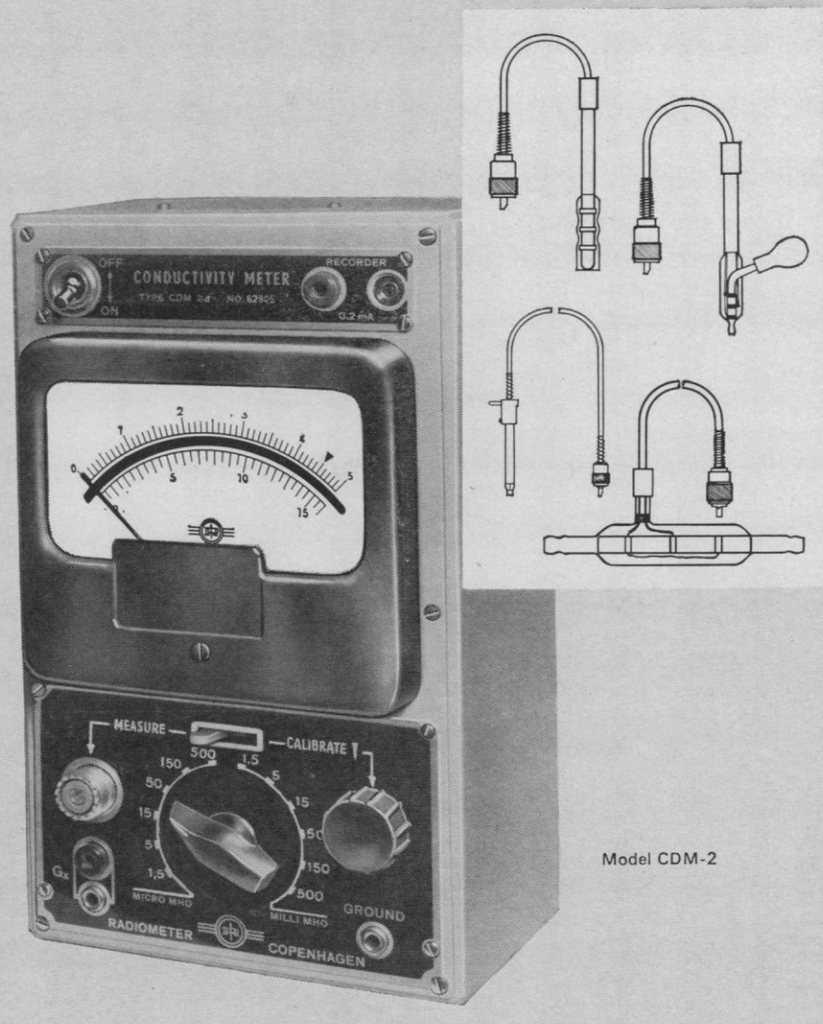

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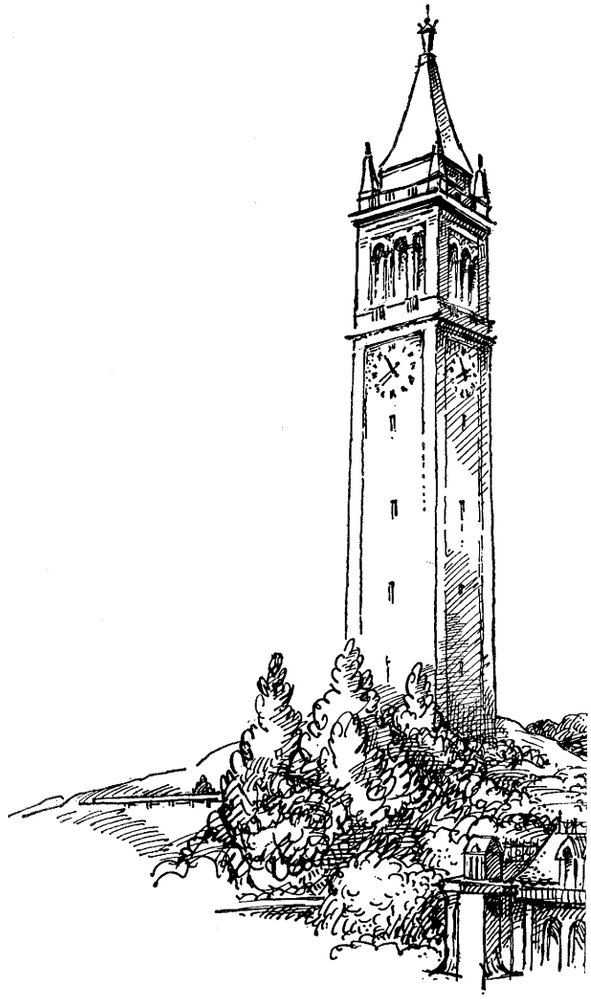

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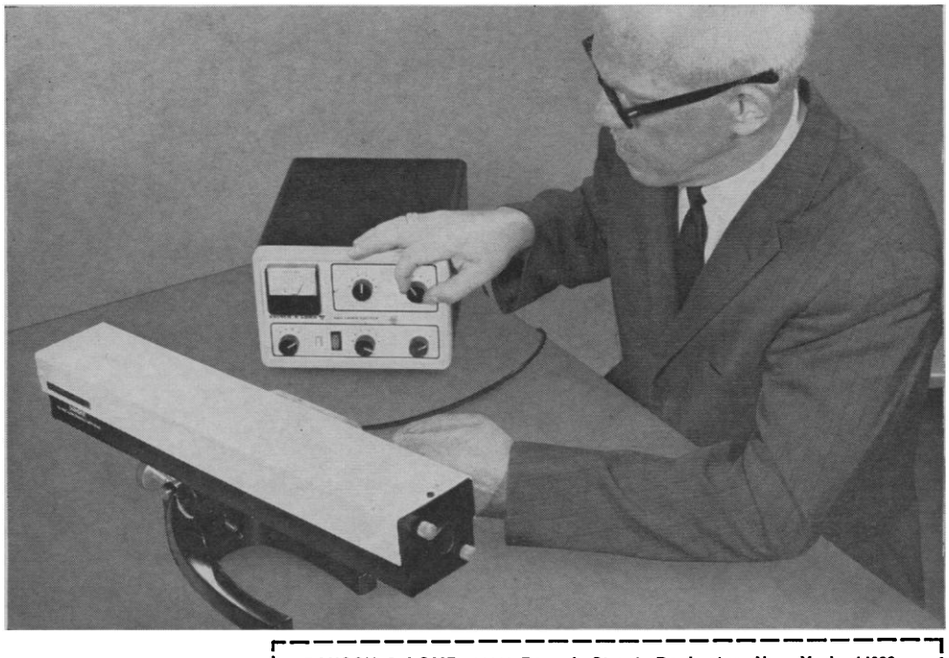

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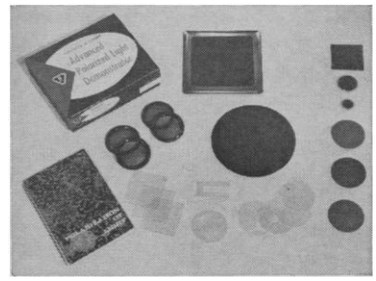

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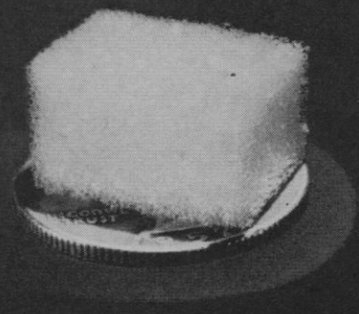
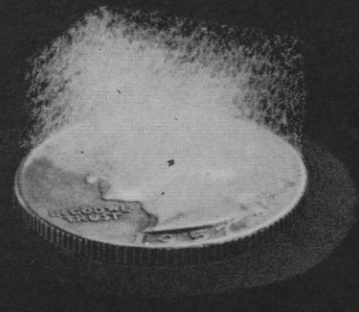
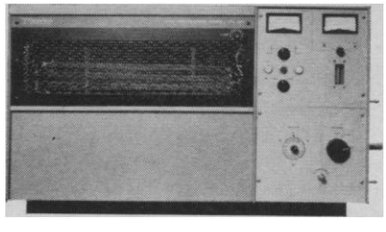


...to its inorganic essence.





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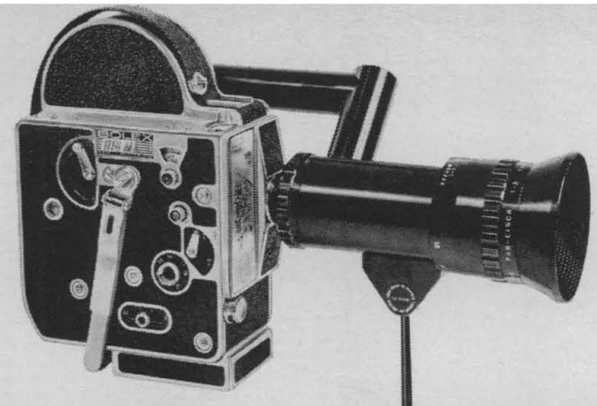

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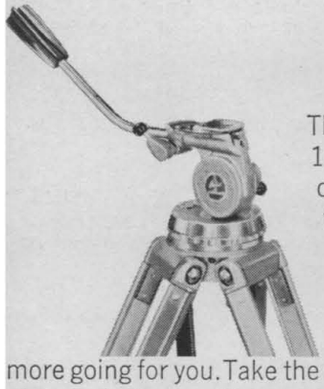

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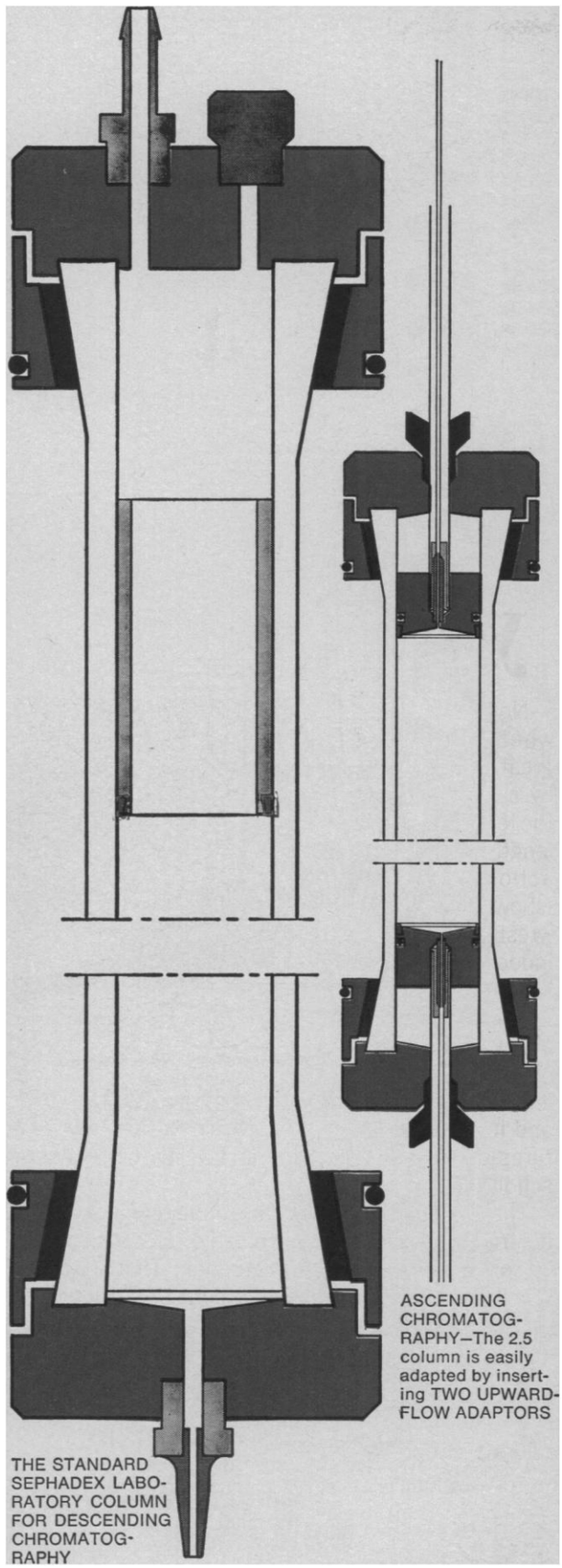

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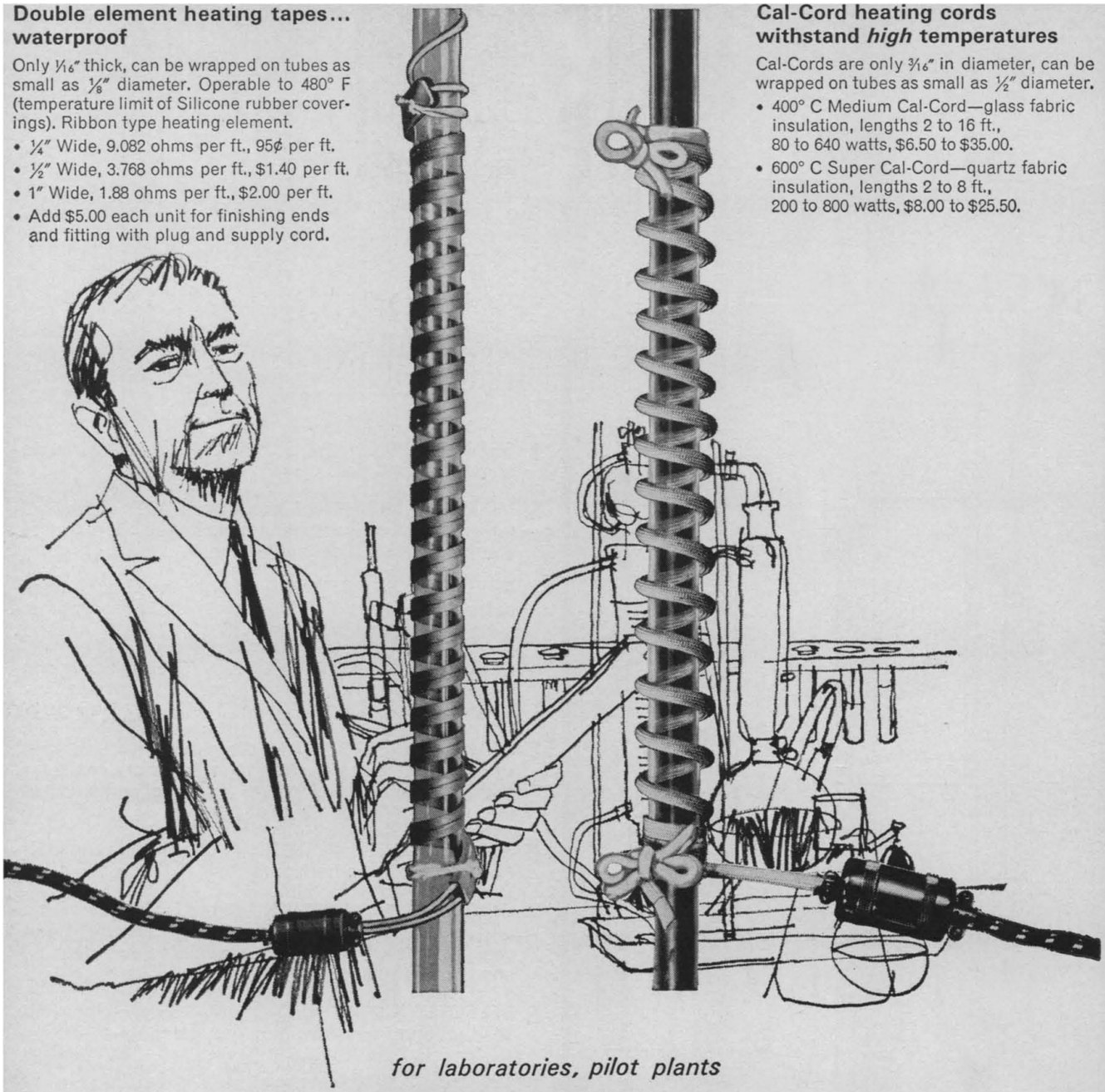

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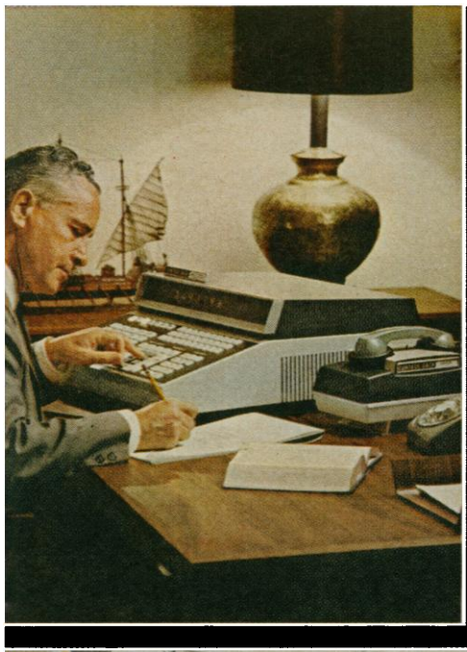

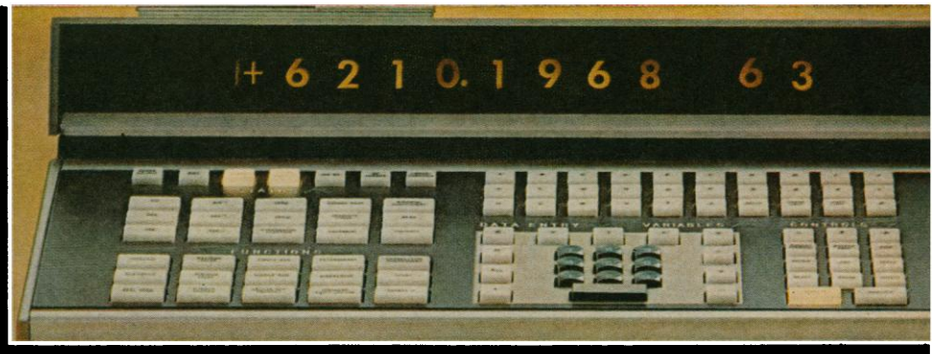

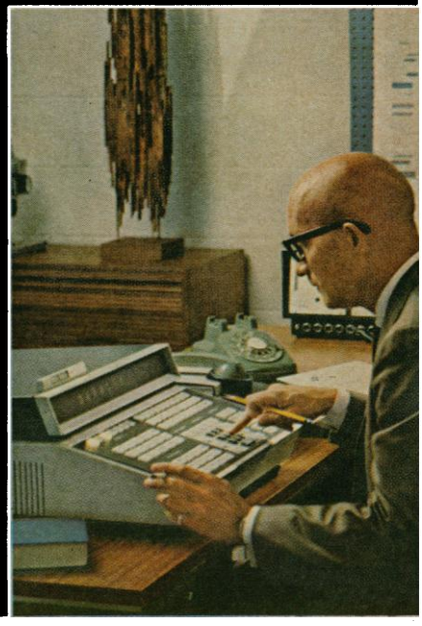

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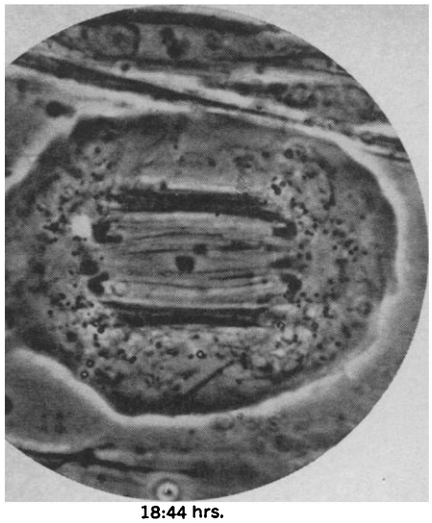

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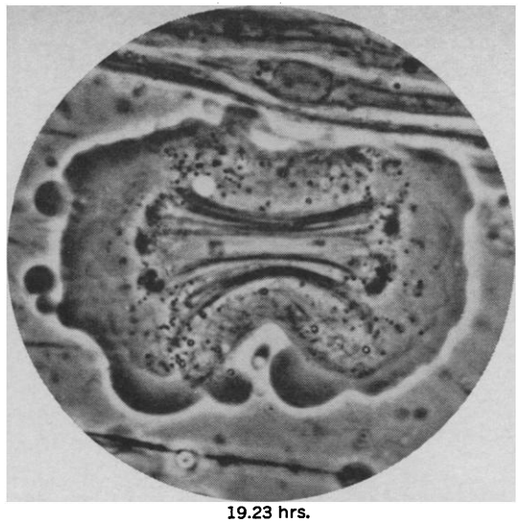

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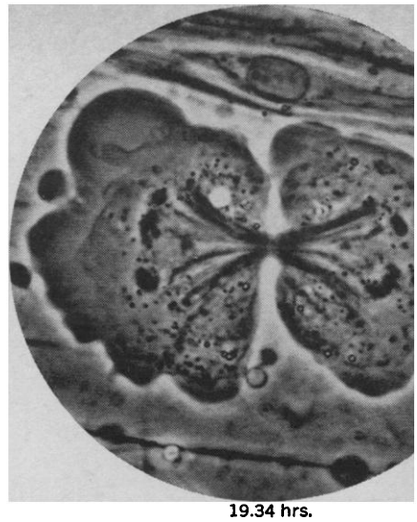

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DAVID H. FULLER

359 Franklin Street,
Wrentham, Massachusetts

Harder by the Dozen

S. T. Fisher ("More on metrics," Letters, 24 Sept., p. 1450) says, "We count by tens because we have ten fingers. But twelve is a much better base. . . ." But is it? The argument usually given in favor of base 12 is that 12 has five divisors: 2, 3, 4, 6, and 12, while 10 has only three divisors: 2, 5, and 10. So let us see what happens, in practice, when we divide a number A by a number B.

1) To start with a truism, A divided by B will give a whole number, with no remainder, if and only if A is a multiple of B. This is quite obvious, but what is apparently less obvious to some people is that it is quite independent of the base m in which A and B are written. In base 10, the number 195 is not divisible by 6; if you rewrite the two numbers in base 12, you find that 143 is still not divisible by 6. The only advantage of B's being a factor of the base m is that you can see at a glance, by looking at the last digit of A, whether A is divisible by B or not. But in the case considered (10 vs. 12) even this advantage is illusory, because it happens that it is fairly easy to find out if a number A written in base 10 is divisible by 3, 4, 6, or 12, and much harder to see if a number A written in base 12 is divisible by 5 or 10.

2) When A is not divisible by B, if we accept the use of common fractions to write the result there is obviously no difficulty, whatever the base used.

3) When A is not divisible by B and we wish to write the result as a decimal fraction (in base 10), we find that, because $10 = 2 \times 5$, the result will be a terminating fraction if B is of the form $2^a \times 5^b$; in all other cases we have an unending (in fact periodic) fraction. In base 12, as $12 = 2 \times 2 \times 3$, we have a terminating fraction if B is of the form $2^a \times 3^b$. Is this an advantage? Only if numbers of the form $2^a \times 3^b$ are more frequently used than those of the form $2^a \times 5^b$, which seems doubtful. In fact the smallest base to give us an advantage in this respect would be $2 \times 3 \times 5 = 30$ (with seven divisors). All those in favor of adopting 30 as a base for our future computations please hold up their hands!

4) So much for the mathematical operation of division. It is easy to see that it is directly applicable to the field of weights and measures. But it may be worth while to consider briefly the special case of a sum of money S which has to be divided equally among B persons. Whatever the currency used, there is always one coin which is smaller than all the others (the cent in the United States). Let us call A the number of such coins to which the sum S is equal. We are brought back to the numerical problem of dividing A by B discussed above, with the additional conclusion that, if A is not a multiple of B, it is impossible to perform the operation exactly. The fact that the currency is based on a scale of 10, or 12, or any other multiple has no influence at all. If anyone is not convinced of this, let him try to divide £5 11s. 7d. into six equal parts. . . .

If the "French and Russian revolutionaries" had indeed adopted the duodecimal system of counting, as Fisher wishes they had, it would have meant a long period of utter confusion. And even when this period was over, schoolchildren learning their addition and multiplication tables would have had to memorize, for each of them, 121 results instead of 81. . . .

E. SYMON

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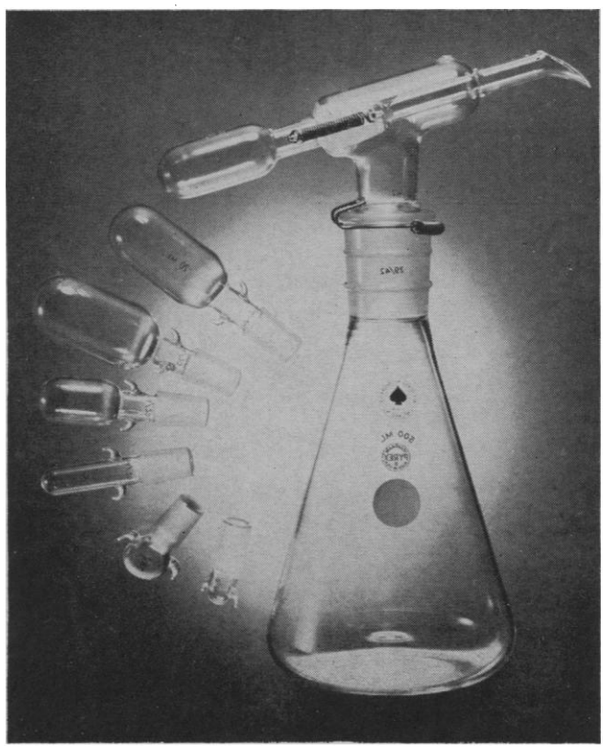

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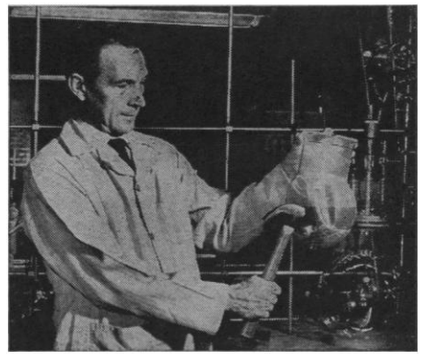

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19 November 1965, Volume 150, Number 3699 **SCIENCE**

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Diversity of Institutional Goals

Too many of the institutions that are changing their roles—typically but by no means exclusively the state teachers colleges that are becoming state colleges or universities—seem to see only one proper model to follow: the great, complex university. They hope to become Harvards, or Berkeleys, or Michigans, or Chicagos.

Many of the institutions on this overcrowded bandwagon will fall off. There are not enough scholars in chemistry or sociology or history to staff first-rate departments in all the institutions that are hunting the formula for Instant Harvard. Accelerators, observatories, great research libraries, and some other specialized facilities cost too much to be placed in every college town. In some fields the critical number of scholars and assistants and the variety of supporting equipment and facilities needed to achieve excellence seem to be increasing, a trend that leads to concentration in fewer centers rather than division among more.

Some universities will make the grade, and the country will be benefited by the increase. But what of those that are going to fail?

They need some dignified alternatives. We need to foster the development of diverse criteria of excellence so that, with realistic appreciation of their own special situations, different institutions can strive toward different goals instead of all trying to head in the same direction. Fortunately, there are enough examples in existence to give hope that there can be more.

One opportunity lies in specialization. Cal Tech is not a universal university; it just tries to be the very best in its chosen fields. Why should not a few institutions strive for comparable quality in the social sciences or the humanities, without worrying about astronomy or engineering?

A few bold institutions could decide to emphasize some relatively unpopular or neglected fields, in which a position of high standing might be achieved quickly. Mechanical engineering and systematic biology are still important, even though they have been living in the shadow of currently more glamorous fields. On a campus where these were the most prestigious departments, they would attract more of the best students.

There are other kinds of specialization. A few college presidents want their institutions to continue to be first-rate liberal arts colleges or to concentrate on training teachers for elementary and secondary schools. There is opportunity for educational excellence in these important areas.

Another opportunity lies in much greater interinstitutional cooperation. Regional compacts, state plans for higher education, and a variety of voluntary arrangements should be encouraged to go farther than they have as yet. Paul Weiss has argued that no single university can any longer hope to be a universal university, and that all must group themselves into communities of universities and colleges. Within such a community each institution could take pride in the accomplishments of the whole and in its contribution to that whole.

To increase the attractiveness of these alternative routes to eminence will require both changes in attitudes among educators and some different formulas for distributing funds. Most of the federal money for higher education is so administered as to put a premium on size, number of students, amount of research, or other characteristics of the big university. Other criteria could be used, but they should be deliberately planned to encourage other lines of development. Simply changing the geographic distribution or increasing the amount in order to be able to lower requirements will not do the job. The more diverse educational goals should be encouraged because they are praiseworthy in their own right, not as consolation prizes.—DAEL WOLFLE

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differences in turnover rates rather than differences in primary structure of histone fractions from various tissues or species.

Barbara E. Wright (Huntington Memorial Hospital of Harvard University) reported on recent studies on control of carbohydrate synthesis in the slime mold (*Dictyostelium discoideum*). In this system differentiation is induced by a change in environment, the removal of exogenous nutrients. In the terminal stage of the differentiation, preformed cellular materials, such as protein, are converted to two complex carbohydrates in the cell wall. It is possible to synthesize labeled carbohydrates with uridine diphosphoglucose-C^{14} in an in vitro system. The enzymes required for this synthesis are very labile in early stages of the differentiation but as differentiation proceeds the enzymes are more stable (or conversely less degradative conditions are encountered). For this reason, changes in enzyme levels cannot yet be measured. It has been established, however, that adequate enzyme levels are present long before cell wall polysaccharide accumulates. More closely correlated with the onset of cell wall polysaccharide synthesis is the accumulation of the precursor compounds, glucose, glucose-6-phosphate, and uridine diphosphoglucose. The level of the latter compound and the kinetics of the cell wall synthesis indicate it is one limiting factor in the cell wall biosynthesis. The work of Wright thus focuses attention on intermediary metabolites as significant factors in differentiation quite separate from any role in a feedback system. In order to prevent regarding this as an oversimplification, she called attention to the fact that differentiation was ultimately a composite of a multiplicity of limiting factors.

James B. Walker (Rice University) discussed metabolite-repressor: receptor interaction during embryonic development. Of the several programmed metabolic events in this system (the chick embryo), few have proven to be subject to external perturbation with physiological compounds. One system is remarkably susceptible, however, and this is the enzyme system for the synthesis of creatine. Walker has shown that the metabolite repressor : receptor interaction of creatine introduced into the developing chick embryo follows saturation kinetics consistent with a reversible interaction with a macromolecule.

J. R. Tata (National Institute for

DISSYMMETRIES

THERMOSTATTED CELL

In a previous column of DISSYMMETRIES (see Science, February 19, 1965, p. 937; Anal. Chem., Vol. 37, No. 1, p. 66A), reference has been made to the numerous papers describing various ways of temperature control in light scattering measurments by means of Brice-Phoenix photometers. We are prompted to take up this subject again by the very interesting contribution of C. Smart from Unilever Research Laboratory in Port Sunlight, Cheshire, England [J. Polymer Sci., *A3*, 3015 (1965)]. He described a thermostatting jacket which allows temperature control to within ± 0.2°C in the temperature range of 0-70°C. The jacket consists of a short section of Pyrex 40 × 40 mm. semioctagonal cell which is clamped between two machined flanges. The lower flange sits on the cell table and accommodates a 24 × 24 mm. Pyrex semioctagonal or square cell that is immersed in liquid paraffin (Nujol). A similar setup apparently is possible with large and small cylindrical cells. (We may point out that our Catalog No. SC-200 temperature control cell holder for the small 1 cm square cell has certain similar features).

A screw cap tightly closes the jacket. Nujol is circulated in a completely enclosed system by pumping it through the jacket and glass heat-exchanger coils in a thermostatted oil bath by means of a small gear pump. The circulating liquid is continuously filtered in this closed system by passing through a Millipore filter before it enters the jacket. In this way the major disadvantage of similar devices where the cell is immersed in a thermostat liquid, i.e., the accumulation of dust particles, is avoided. Nujol as circulating liquid has the additional advantage of having a refractive index very close to that of Pyrex. This reduces stray reflections within the thermostatting jacket as evidenced by values close to unity for the dissymmetry obtained for water and dilute aqueous solutions.

INCREASED SENSITIVITY

In the same paper, Dr. Smart described a modification of the output circuit of the photometer that leads, in combination with a Phoenix potentiometric strip chart recorder, to a considerable increase in the sensitivity while maintaining a favorable signal-to-noise ratio (about 100 : 1). The increase in the sensitivity is based on the fact that the recorder has a very high input impedance. Because of this, it is possible to increase the output signal by measuring the potential drop across a larger proportion of the cathode load resistance. By means of a switch, different fixed tapping points along the cathode load can be selected to give either normal sensitivity or two increased sensitivities.

As a check of the performance of the thermostatting jacket described above, Dr. Smart determined the Rayleigh ratio of benzene and water at an angle of 90°, at room temperature. The absolute calibration was based on the use of an opal glass standard diffusor in combination with Brice's method. Both for benzene and water the results agree closely with the most reliable values from the literature. This is particularly significant in the case of Rayleigh ratio determination of water in smaller cells where stray light appears generally to be somewhat greater than in larger cells. Since water scatters so little, a small amount of stray light can easily lead to measured intensities which are too high.

LIGHT SCATTERING BY PURE WATER

In connection with Smart's results for water, it may be of interest to note a very comprehensive study of the light scattering properties of water published recently by J. P. Kratohvil, M. Kerker and L. E. Oppenheimer of Clarkson College of Technology in Potsdam, N. Y. [J. Chem. Phys., *43*, 914 (1965)]. Two Brice-Phoenix photometers, one of which was slightly modified, and a variety of cells of different sizes and shapes were utilized. By carefully evaluating the problems of stray light, absolute calibration and presence of dust particles, and by critically reviewing the literature data, these authors were able to demonstrate a close agreement between the measured Rayleigh ratio of water at an angle of 90° and that calculated from Einstein's fluctuation treatment when corrected for observed depolarization. The best values of Rayleigh ratio, R_{90}, appear to be 2.6×10^{-6} and 1.0×10^{-6} cm^{-1} at 436 and 546 mu. The ratio of these two values is very close to the theoretical ratio (2.62) for the same wavelengths.

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Medical Research, London) spoke on growth and developmental hormones as tools for the study of biosynthetic control mechanisms. He reviewed the effects of hormones on nucleic acid synthesis. It is now apparent that several hormones promote RNA synthesis in target organs as one of the very early observable effects. Tata presented data for the thyroid hormone induction of metamorphosis in the American bullfrog. The lag period for the precocious production of proteins which appear following thyroid hormone was shown to be one of active RNA synthesis. Density gradient studies during this period (40 to 60 hours after administering) showed newly formed polysomes, presumably bearing mRNA for the new protein synthesis that was to follow. It was stressed that an increase in mRNA is not the only means for increasing new protein synthesis. Stimulation of other RNA synthesis (ribosomal and sRNA) would effectively increase the synthetic machinery for the synthesis and, in fact, may be as important to hormone action as mRNA synthesis. Labeling patterns in the sequence of RNA polymerase increase during the combined action of growth and thyroid hormones on liver in hypophysectomized rats indicate that the two hormones act at different initial sites. In conclusion, Tata stressed that the many levels at which hormones act make the hormones versatile tools in exploring regulatory mechanisms in higher organisms during development.

Ulrich Clever (Purdue University) reported on the control of gene activity as a factor of cell differentiation in insect development. Certain insects are particularly suited to the study of gene activity because the "puffing" phenomena may be correlated with an active gene. The use of the hormone ecdysone to induce differentiation provides still another dimension to such studies. Clever described changes induced in chromosome activity in *Chironemus tentrans* and those genes which were directly affected by ecdysone. The primary target of the hormone appeared to be the same in different stages of development and in different tissues even though the final cell reactions were not the same. Also, certain genes must be active in order for other genes to respond to ecdysone (temporal and sequential action). These effects may be shown in two ways. First, the age of the insect (larva-pupa) is important to the action of the

hormone. Second, the application of actinomycin D may alter the course of the response to ecdysone. Some "puffs" may be activated in the absence of protein synthesis (puromycin resistant), while others require protein synthesis for activation.

Jean D. Wilson (University of Texas Southwestern Medical School, Dallas, Texas) and Peter M. Loeb reported on their studies on control by estrogen and androgen of cell biosynthesis in target organs, delineating still further the site of action of the sex hormones in target organs. Wilson and Loeb have studied labeled-testosterone localization in the preen gland of the duck. They concluded that testosterone label localized in an area of the cell actively synthesizing RNA in this tissue.

Using the crested newt as test material, they showed by autoradiography that tritiated estradiol localizes in the lampbrush chromosomes in ovary nuclei, presumably the site of active gene transcription. These studies suggest the mechanism of action of estrogen and androgen involves the regulation of specific gene activity. In the case of testosterone, this regulation appears to involve some types of reaction with the histone or protein associated with the DNA.

Regulation of enzyme action by metabolites was discussed by Carl Frieden (Washington University, St. Louis, Missouri). The enzymes considered were those whose activity is influenced by metabolites or end products which are not substrates for the enzyme. Several such examples are now known. This form of enzyme control is involved in three types of regulation: (i) those enzymes whose control will influence the particular metabolic pathway relative to other possible metabolic pathways; (ii) those enzyme-metabolite interactions which will affect enzyme subunit interaction to affect enzyme activity and thus metabolic rate; and (iii) those enzyme-metabolite interactions which affect primarily enzyme kinetics. All three types of regulation may be explained as allosteric effects.

Some forms of human disease can be considered in terms of regulatory mechanisms that involve control genes and structural genes. Genetic regulatory mechanisms as exemplified by human disease was discussed by Alexander G. Bearn (Rockefeller Institute). Bearn cited genetic studies on the transferrins, gamma globulins, bisalbuminemia, and others as specific ex-

amples of structural gene mutations that have been studied for human plasma proteins. In the erythrocyte proteins a very impressive series has been accumulated, including the several known hemoglobin variants, Thalassemia (several suspected structural mutations, at least), and blood group substances. Several examples were also furnished for human disease that have been analyzed as control gene mutations (for example, high fetal hemoglobin, hemophilia A and B, and an α_1 antitrypsin disease which produces an unusual emphysema).

Altered template stability in rat hepatomas has been shown to be an important aspect of tumors by Henry C. Pitot and co-workers (McArdle Laboratory, University of Wisconsin, Madison). Studies reported by Pitot have shown enzyme template stability in several minimal deviation hepatomas to vary considerably. In some of these highly differentiated tumors half-life of the template, as studied by the duration of the actinomycin D resitant period, may be very near or even greater than the normal liver stability, but in others the corresponding value is much decreased.

Since it has been known for some time that hepatomas fail to respond to normal enzyme inductions (for example, synthesis induced by substrates or hormones), it is possible this defective control of enzyme synthesis in hepatomas is related to the altered template stability.

Marvin D. Siperstein (University of Texas Southwestern Medical School, Dallas, Texas) has made a comparison of feed-back mechanisms of cholesterol metabolism in liver and hepatoma. The normal liver is subject to control of cholesterol biosynthesis at the point of conversion of β-hydroxy-β-methylglutarate to mevalomate by an end-product inhibition. The control appears to be related to a site in the membrane portion of the liver microsome fraction. This control is absent in hepatoma for which Siperstein postulates a steric alteration of the site.

In a paper on regulatory steps in the replication of mammalian cell nuclei Gerald C. Mueller (University of Wisconsin) presented evidence for sequential steps in replication. Cultures of HeLa or human lymphocytes, synchronized by temporary amethopterin block, were studied. Some distinction in the replication cycle could be shown by inhibition of replication if the analog 5-bromodeoxyuridine were incor-

porated into early replicated DNA but not in late replicated DNA. This late replicated DNA is essential for cell division, because blockage by phleomycin is selective for this portion of DNA replication. Inhibition by phleomycin, puromycin, or parafluorophenylalanine showed that both RNA synthesis and protein synthesis were required for triggering replication.

A. Clark Griffin (University of Texas M. D. Anderson Hospital) made a comparison of protein-synthesizing systems from normal and tumor tissues. Studies were carried out on in vitro amino acid incorporating systems isolated from Novikoff ascites tumor cells, rat liver, and *Escherichia coli*. The ascites tumor and liver components were completely interchangeable in terms of amino acid activation or incorporation. Synthetases from tumor or liver would form the aminoacyl-sRNA (for sixteen amino acids that were tested) in the presence of sRNA isolated from liver or tumor. The tumor synthetase fraction catalyzed the formation of arginyl-sRNA in the presence of yeast sRNA while liver synthetase fraction failed to catalyze this reaction.

Specificity of the transfer enzymes was also studied. Carbon-14–labeled aminoacyl sRNA's were added to the ribosomes along with energy components. In each system the corresponding transfer enzyme fraction was essential for amino acid incorporation, as measured by insolubility in hot trichloroacetic acid. Tumor and liver systems were interchangeable while *E. coli* ribosomes would not respond to the mammalian transfer enzymes.

It is important that a means of studying gene combinations in cells of higher organisms be available. Hybridization of cells presents the most direct approach currently available for such studies. In discussing hybridization of somatic cells and phenotypic expression, Boris Ephrussi (Western Reserve, Cleveland, Ohio) reported on his work in this field.

From studies of the phenotypic expression of hybridized cells, examples of production of two forms of β-glucuronidase were cited, each form deriving originally from the parent strain. In other cases enzyme forms have been suppressed in hybrids by a regulatory interaction, because under other conditions of culture the enzyme (esterase) could be made to reappear. These findings are interpreted as consistent with the modern form of the deletion theory

of carcinogenesis which states that carcinogenesis involves deletion or alteration of a regulatory mechanism, not a structural gene.

Since 1950 a traditional highlight in this symposium is the presentation of the Bertner Award for Outstanding Achievement in the Field of Cancer Research. This year's recipient was Erwin Chargaff (Columbia University College of Physicians and Surgeons, New York). In the award presentation by R. Lee Clark (University of Texas M. D. Anderson Hospital and Tumor Institute) Chargaff was cited for his numerous contributions to nucleic acid chemistry, and particularly for the careful analytical studies which established the adenine-thymine and guanine-cytosine regulatorities in the base composition of DNA. After accepting the award, Chargaff spoke on the biological consequences of base-pairing in nucleic acids. The lecture began with some thoughtful comments on contemporary science, then briefly reviewed some of the contributions of Chargaff and his co-workers concerning base-pairing.

A final subject of the lecture concerned recently gathered evidence for the symparallel or antiparallel polarity of the strands in native DNA. Josse, Kaiser, and Kornberg have presented nearest-neighbor frequency studies of in vitro, enzymatically synthesized, DNA which indicate an antiparallel alignment. Chargaff's studies approach the problem using native DNA as the material investigated and a detailed analysis of the resulting isostiches containing one or two bases. The isolated isostiches can be analyzed for their sequence (for example, pApGp versus pGpAp) and the resulting distributions of isostich-two content compared with that expected for a syn- or antimodel of DNA strands. The data are in accord with the antiparallel model, thus affording experimental support for assumptions that have long been held for native DNA.

The symposium was supported by grants from the National Cancer Institute, U.S. Public Health Service, and the American Cancer Society, Texas Division. The full text of the papers will be published as a monograph entitled "Developmental and Metabolic Control Mechanisms and Neoplasia."

DARRELL N. WARD
Department of Biochemistry, University of Texas M. D. Anderson Hospital and Tumor Institute, Houston

Forthcoming Events

November

26–27. **Interactions of Space Vehicles with an Ionized Atmosphere**, 2nd symp., Univ. of Miami, Coral Gables, Fla. (A. R. Hochstim, Inst. for Defense Analyses, 400 Army-Navy Drive, Arlington, Va.)

28–3. **Radiological** Soc. of North America, Chicago, Ill. (M. D. Frazer, 713 Genesee St., Syracuse, N.Y.)

28–4. **Odontological** Federation of Central America and Panama, San Jose, Costa Rica. (R. Pauly S., Univ. of Costa Rica, San Jose)

29–30. Biochemical and Pharmacological Aspects of **Basal Ganglia Disease**, symp., Columbia Univ. College of Physicians and Surgeons, New York, N.Y. (M. D. Yahr, New York Neurological Inst., 710 W. 168 St., New York 10032)

29–2. **Entomological** Soc. of America, New Orleans, La. (R. H. Nelson, ESA, 4603 Calvert Rd., College Park, Md.)

29–3. **Metallurgy**, 1st operating conf., Pittsburgh, Pa. (Metallurgical Soc. of American Inst. of Mechanical Engineers, 345 E. 47 St., New York 10017)

29–3. **Phytopharmacology**, intern. conf., Amsterdam, Netherlands. (California Chemical S.A. Française, 19, avenue George V, Paris 8e)

29–4. **Space Technology and Science**, 6th intern. symp., Tokyo, Japan. (D. Mori, Inst. of Space and Aeronautical Science, Univ. of Tokyo, 856 Koma-ba-machi, Meguro-ku, Tokyo)

29–8. **Rehabilitation of Persons with Dulled Sensory Perception**, intern conf., Braunschweig, Germany. (Sonnenberg Intern. Center, P.O. Box 460, 33 Braunschweig)

30–2. **Computers**, fall conf., Las Vegas, Nev. (R. Sheehy, Bunker-Ramo Co., 8433 Fallbrook Ave., Canoga Park, Calif.)

December

1–3. **Ultrasonics**, symp., Boston, Mass. (J. H. Rowen, Bell Telephone Laboratories, Murray Hill, N.J. 07971)

1–3. American **Water Resources** Assoc., first annual, Univ. of Chicago, Chicago, Ill. (AWRA, P.O. Box 434, Urbana, Ill.)

2–3. **Bone Marrow**, conf., San Francisco, Calif. (L. J. Cole, Experimental Pathology Branch, U.S. Naval Radiological Defense Laboratory, Hunter Point, San Francisco 94135)

2–3. Northern Gulf Coordinating Council on **Wildlife Management and Mosquito Control**, mtg., New Orleans, La. (G. R. Hayes, Jr., P.O. Box 60630, New Orleans 70160)

2–3. Society of **Plastics Engineers**, regional technical conf., Newark, N.J. (SPE, 65 Prospect St., Stamford, Conn. 06902)

3–5. **Leptospiras**, intern. colloquium, Antwerp, Belgium. (A. Grare, Inst. de Médicine Tropicale, Prince-Leopold, Antwerp)

3–5. Academy of **Psychoanalysis**, midwinter meeting, New York, N.Y. (H. Davidman, 125 E. 65 St., New York)

3–5. American **Psychoanalytic** Assoc., fall meeting, New York, N.Y. (APA, 1 E. 57 St., New York 10022)

3–4. **Macromolecular Metabolism**, symp., New York, N.Y. (New York Heart

Assoc., 10 Columbus Circle, New York 10019)

5. American Acad. of **Dental Medicine**, mid-winter annual meeting, New York, N.Y. (S. Conrad, 133–28 228th St., Laurelton, N.Y. 11413)

5–9. American Inst. of **Chemical Engineers**, Philadelphia, Pa. (AICE, 345 E. 47 St., New York 10017)

5–11. American **Rheumatism** Assoc., congr., Mar del Plata, Argentina. (G. Speyer, 10 Columbus Circle, New York)

6. **Food Law** Inst. and Food and Drug Administration, joint educational conf., Washington, D.C. (FDA, Washington, D.C.)

6–7. Medical and Social Aspects of **Migration**, Ciba Foundation guest symp., London, England. (Ciba, 41 Portland Pl., London, W.1)

6–8. **Transmission of Viruses** by the Water Route, symp., Cincinnati, Ohio. (G. Berg, U.S. Public Health Service, 4676 Columbia Parkway, Cincinnati 45226)

6–10. **Space Communication**, Paris, France. (UNESCO, Pl. de Fontenoy, Paris 7e)

6–10. Practices in the Treatment of Low and Intermediate Level **Radioactive Wastes**, symp., Vienna, Austria. (Intern. Atomic Energy Agency, Kärtner Ring 11, Vienna 1)

6–10. Structure and Function of the **Nucleolus**, symp., Montevideo, Uruguay. (F. A. Saez, Instituto de Investigaciones de Ciencias Biológicas, avda. Italia 3318, Montevideo)

6–12. **Hydraulics and Fluid Mechanics**, 2nd Australasian conf., Auckland, New Zealand. (A. J. Raudkivi, Univ. of Auckland, School of Engineering, Ardmore College Post Office, Auckland)

7–10. American Soc. of **Agricultural Engineers**, winter meeting, Chicago, Ill. (J. L. Butt, P.O. Box 229, St. Joseph, Mich.)

8–10. **Coccidioidomycosis**, 2nd natl. symp., Phoenix, Ariz. (Arizona Tuberculosis and Health Assoc., 733 W. McDowell Rd., Phoenix 85007)

8–10. Changing Concepts of **Human Habitation**, symp., Roorkee, India. (D. Mohan, Central Building Research Inst., Roorkee)

8–10. New Concepts in **Gynecological Oncology**, symp., Hahnemann Medical College and Hospital, Philadelphia, Pa. (Miss S. Rosen, Hahnemann Medical College and Hospital, 230 N. Broad St., Philadelphia 19102)

8–15. American Acad. of **Optometry**, Chicago, Ill. (C. C. Koch, 1506 Foshay Tower, Minneapolis, Minn.)

9–10. **Ciba Foundation** guest meeting European Pancreatic Club. London, England. (H. T. Howat, 41 Portland Pl., London, W.1)

12–14. **Lymphatic System**, intern. conf., New Orleans, La. (H. S. Mayerson, Dept. of Physiology, School of Medicine, Tulane Univ., New Orleans 70112)

13–15. **Aerothermochemistry of Turbulent Flows**, conf., American Inst. of Aeronautics and Astronautics, San Diego, Calif. (H. Yoshihara, Space Sciences Laboratory, Mail Zone, 596–00, General Dynamics/Astronautics, Kearny Villa Rd., San Diego)

13–15. European **Biological Editors**,

Paris, France. (D. S. Ferner, Dept. of Biology, Univ. of Washington, Seattle)

13–15. Radiological Protection in the **Industrial Use of Radioisotopes**, intern. conf., Paris, France. (J Pradel, 66 rue Augustin Dumont, Malakoff, Seine, France)

13–18. **Engineering and Technological Sciences**, conf., Bangkok, Thailand. (P. Purachatra, Assoc. of Southeast Asian Insts. of Higher Learning, Chulalongkorn Univ., Race Course Rd., Bangkok)

15–18. **Microbiology**, 1st Central American congr., Univ. of Costa Rica, San José. (F. Montero-Gei, School of Microbiology, Univ. of Costa Rica, Apartado 2157, San José)

16–17. **Computers and Scanning**, New Orleans, La. (S. Crain, University College, Tulane Univ., New Orleans 70118)

19–21. Middle East **Neurological** Soc., Jerusalem, Jordan. (F. S. Haddad, Orient Hospital, Beirut, Lebanon)

19–23. Indian **Statistical** Inst., Malleswaram, Bangalore. (S. R. Ranganathan, Indian Statistical Inst., Documentation Research and Training Centre, 112 Cross Rd. 11, Malleswaram)

20–21. **Molecular Transport and Rate Phenomena**, 32nd annual chemical engineering symp., Stanford Univ., Stanford, Calif. (A. Acrivos, Dept. of Chemical Engineering, Stanford Univ., Stanford, Calif.)

20–21. **Nuclear Medicine**, 2nd natl. congr., Tel Aviv, Israel. (P. Czerniak, Israel Atomic Commission, Soreq Nuclear Research Center, Doar Yavne)

20–22. British **Biophysical** Soc., 20th winter meeting, London, England. (R. E. Burge, Physics Dept., Queen Elizabeth College, Campden Hill Rd., London W.8)

20–22. American **Physical** Soc., Los Angeles, Calif. (W. Whaling, California Inst. of Technology, Pasadena 91109)

26–31. **American Assoc. for the Advancement of Science**, annual, Berkeley, Calif. (R. L. Taylor, AAAS, 1515 Massachusetts Ave., NW, Washington, D.C.)

In addition to the 20 sections of the Association and five AAAS committees, the following organizations have arranged sessions at the AAAS annual meeting 26–31 December at Berkeley:

Mathematics

American Mathematical Soc. (R. S. Pierce, Univ. of Washington, Seattle)

Association for Computing Machinery. (H. D. Huskey, Univ. of California, Berkeley)

National Council of Teachers of Mathematics. (J. D. Gates, 1201 16 St., NW, Washington, D.C.)

Society for Industrial and Applied Mathematics (J. H. Griesmer, IBM, Yorktown Heights, N.Y.)

Physics

American Astronautical Soc. (P. B. Richards, General Precision, Little Falls, N.J.)

Chemistry

American Chemical Soc., California Section. (R. L. LeTourneau, Chevron Research Co., Richmond, Calif.)

Astronomy

American Astronomical Soc. (G. C. McVittie, Univ. of Illinois, Urbana)

Geology and Geography

Association of American Geographers. (M. Mikesell, Univ. of Chicago, Chicago, Ill.)

National Geographic Soc. (R. Gray, 17th & M Sts., NW, Washington, D.C.)

National Speleological Soc. (G. W. Moore, U.S. Geological Survey, Menlo Park, Calif.)

Zoological Sciences

American Fisheries Soc. (H. K. Chadwick, California Dept. of Fish and Game, Sacramento)

American Soc. of Zoologists. (A. G. Richards, Univ. of Minnesota, St. Paul)

Animal Behavior Soc. (E. M. Banks, Univ. of Illinois, Urbana)

Herpetologists' League. (F. B. Turner, Univ. of California, Los Angeles)

Society of Systematic Zoology. (J. G. Rozen, Jr., American Museum of Natural History, New York, N.Y.)

Zoological and Botanical Sciences

American Soc. of Naturalists. (C. Hubbs, Scripps Inst. of Oceanography, La Jolla, Calif.)

Ecological Soc. of America (G. M. Woodwell, Brookhaven Natl. Laboratory, Upton, L.I., N.Y.)

Western Soc. of Naturalists. (J. M. Craig, San Jose State College, San Jose, Calif.)

Psychology

Western Psychological Assoc. (G. A. Mendelsohn, Univ. of California, Berkeley)

Social and Economic Sciences

American Economic Assoc. (R. R. Nelson, RAND Corp., Santa Monica, Calif.)

American Political Science Assoc. (J. F. Triska, Stanford Univ., Stanford, Calif.)

American Soc. of Criminology. (C. Newman, Univ. of Louisville, Louisville, Ky.)

American Sociological Assoc. (W. Form, Michigan State Univ., East Lansing)

Metric Assoc. (R. Fischelis, Ohio Northern Univ., Ada)

National Inst. of Social and Behavioral Science. (D. P. Ray, 863 Benjamin Franklin Station, Washington, D.C)

Population Assoc. of America (E. S. Lee, Univ. of Pennsylvania, Philadelphia)

Society for the Scientific Study of Religion. (C. Y. Glock, Univ. of California, Berkeley)

History and Philosophy of Science

Philosophy of Science Assoc. (C. W. Churchman, Univ. of California, Berkeley)

Society for General Systems Research. (H. Thal-Larsen, Univ. of California, Berkeley)

Science Courses for Baccalaureate Education Project. (V. L. Parsegian, Rensselaer Polytechnic Inst., Troy, N.Y.)

Medical Sciences

Alpha Epsilon Delta. (M. L. Moore, 7 Brookside Circle, Bronxville, N.Y.)

American Assoc. of Bioanalysts, Western Region. (M. Menesini, 1287 Rudgear Rd., Walnut Creek, Calif.)

American Physiological Soc. (R. M. Iverson, Univ. of Miami, Coral Gables, Fla.)

American Soc. for Microbiology, North-

ern California–Hawaiian Branch. (K. J. Taylor, Cutter Laboratories, Berkeley, Calif.)

California Veterinary Medical Assoc. (A. G. Edward, Univ. of California, Davis)

Society for Experimental Biology and Medicine, Pacific Coast Section. (E. L. Dobson, Donner Laboratories, Univ. of California, Berkeley)

Education

Commission on Science Education. (J. R. Mayor, AAAS, 1515 Massachusetts Ave., NW, Washington, D.C. 20005)

American Nature Study Soc. (H. E. Weaver, Univ. of Illinois, Urbana)

National Assoc. for Research in Science Teaching. (F. B. Dutton, Michigan State Univ., East Lansing)

National Assoc. of Biology Teachers. (H. K. Wong, Menlo-Atherton High School, Atherton, Calif.)

National Science Teachers Assoc. (A. F. Eiss, 1201 16 St., NW, Washington, D.C. 20005)

Information and Communication

National Assoc. of Science Writers. (L. S. Zahn, Hill and Knowlton Inc., 150 E. 42 St., New York, N.Y.)

Society of Technical Writers and Publishers. (G. Marx, Illinois Inst. of Technology, Chicago)

Statistics

BIO: Biomedical Information-Processing Organization. (M. Woodbury, New York Univ. Medical Center, New York, N.Y.)

Biometric Soc., ENAR. (D. S. Robson, Cornell Univ., Ithaca, N.Y.)

Biometric Soc., WNAR. (S. W. Nash, Univ. of British Columbia, Vancouver, Canada)

Mathematical Statistics and Probability, 5th Berkeley symp. (J. Neyman, Statistical Laboratory, Univ. of California, Berkeley)

Science in General

Academy Conf. (J. T. Self, Univ. of Oklahoma, Norman)

Scientific Research Soc. of America (D. B. Prentice. 51 Prospect St., New Haven, Conn.)

Sigma Delta Epsilon. (Miss A. Hanson, Univ. of Minnesota, Minneapolis)

Society of the Sigma Xi. (T. T. Holme, 51 Prospect St., New Haven, Conn.)

27–29. Academy of **Management**, New York, N.Y. (P. P. LeBreton, College of Business Administration, Univ. of Washington, Seattle)

27–30. **Differential Equations and Dynamical Systems**. Univ. of Puerto Rico, Mayaguez. (Center for Dynamical Systems, Brown Univ., Providence, R.I.)

27–30. **Phi Delta Kappa**, Professional Education Fraternity, Univ. of Oklahoma, Norman. (M. Bemis, Phi Delta Kappa, 8th and Union, Bloomington, Ind. 47402)

28–30. Indian **Medical** Assoc., 41st conf., Baroda (Gujarat). (Indian Medical Assoc. House, Indraprastha Marg., New Delhi 1)

29–4. **Pugwash Conf. on Science and World Affairs**, Addis Ababa, Ethiopia. (J. Rotblat, Pugwash Continuing Committee, 8 Asmara Rd., London, N.W.2, England)

NEW BOOKS

(Continued from page 1021)

The Mystery of Matter. Prepared by the American Foundation for Continuing Education. Louise B. Young, Ed. Oxford Univ. Press, New York, 1965. 726 pp. Illus. $10. One hundred selected writings on the following topics: Can matter be measured? (1 paper); Is matter infinitely divisible? (10 papers); Is matter substance or form? (9 papers); What is the secret of atomic energy? (13 papers); Is the universe asymmetric? (6 papers); What is the origin of living matter? (11 papers); Is living matter immortal? (10 papers); Does order arise from disorder? (8 papers); What is life? (13 papers); Will fallout affect the course of evolution? (8 papers); and Is science destroyer or creator? (11 papers).

Neighbors of the Earth: Planets, Comets, and the Debris of Space. Thornton Page and Lou Williams Page, Eds. Macmillan, New York, 1965. 352 pp. Illus. $7.95. The Macmillan Sky and Telescope Library of Astronomy, vol. 2. A compilation of 113 articles published during the last 34 years in *The Telescope, The Sky*, and *Sky and Telescope*. The topics are: The warmer planets: Mercury and Venus (21 papers); Mars, abode of life? (23 papers); the major planets and Pluto (26 papers); Asteroids: Bits or pieces? (4 papers); Comets, so different from the rest (10 papers); Meteors, meteorites, and meteoroids (9 papers); Atmospheres, aurorae, and exospheres (12 papers); and The debris of interplanetary space (8 papers).

The New Intelligent Man's Guide to Science. Isaac Asimov. Basic Books, New York, ed. 2, 1965. 880 pp. Illus. $9.95 until 31 Dec. 1965; $12.50.

New Light on Space and Time. Dewey B. Larson. North Pacific Publishers, Portland, Ore., 1965. 272 pp. Illus. $6.

The New Treasury of Science. Harlow Shapley, Samuel Rapport, and Helen Wright. Harper and Row, New York, 1965. 780 pp. Illus. $8.95. Based on the Treasury of Science (1943); of the 84 papers in this edition, 27 appeared in the original 1943 edition.

Phosphates in Agriculture. Vincent Sauchelli, Reinhold, New York; Chapman and Hall, London, ed. 2, 1965. 285 pp. Illus. $12.50.

Photography for Scientific Publication: A Handbook. Alfred A. Blaker. Freeman, San Francisco, 1965. 170 pp. Illus. $8.

The Planet Uranus: A History of Observation, Theory, and Discovery. A. F. O'D. Alexander. Elsevier, New York, 1965. 316 pp. Illus. $12.75.

Porteus Maze Test: Fifty Years' Application. Stanley D. Porteus. Pacific Books, Palo Alto, Calif., 1965. 328 pp. Illus. $7.50.

The Prediction of Academic Performance: A Theoretical Analysis and Review of Research. David E. Lavin. Russell Sage Foundation, New York, 1965. 182 pp. Illus. $4.

Pulping Processes. Sven A. Rydholm. Interscience (Wiley), New York, 1965. 1279 pp. Illus. $37.50.

Ritual of the Bacabs. Translated and

edited by Ralph L. Roys. Univ. of Oklahoma Press, Norman, 1965. 223 pp. Illus. $5.95.

The Savage and the Innocent. David Maybury-Lewis. World, Cleveland, Ohio, 1965. 270 pp. Illus. $4.95.

Scales and Weights: A Historical Outline. Bruno Kisch. Yale Univ. Press, New Haven, Conn., 1965. 321 pp. Illus. $15.

Science and Culture: A Study of Cohesive and Disjunctive Forces. Gerald Holton, Ed. Houghton Mifflin, Boston, Mass., 1965. 384 pp. $6. The Daedalus Library, vol. 4. Fifteen papers contributed by Harry Levin, James S. Ackerman, Edmund R. Leach, Talcott Parsons, Harvey Brooks, Gerald Holton, Don K. Price, Gyorgy Kepes, Margaret Mead, Oscar Handlin, Eric Weil, Herbert Marcuse, Daniel Bell, René Dubos, and Robert S. Morison and a report by the American Association for the Advancement of Science Committee on Science in the Promotion of Human Welfare.

Science and Society. Norman Kaplan, Ed. Rand McNally, Chicago, Ill., 1965. 625 pp. Illus. Rand McNally Sociology Series; 39 papers on the following topics: Prologue to the present (6 papers); Science as a changing institution (4 papers); Scientific research and laboratory organization (5 papers); National science establishments (7 papers); Science and policy (7 papers); and Prologue to the future (10 papers).

Science in History. J. D. Bernal. Hawthorn, New York, ed. 3, 1965. 1067 pp. $12.95.

Science in Hungary. Tibor Erdey-Gruz and Imre Trencsenyi-Waldapfel, Eds. Corvina Press, Budapest, Hungary, 1965. 348 pp. Illus. Twenty papers.

Science in Nineteenth-Century America: A Documentary History. Nathan Reingold, Ed. Hill and Wang, New York, 1964. 351 pp. Illus. Paper, $2.45. American Century Series.

Selected Papers of John Shaw Billings. Compiled, with a life of Billings, by Frank Bradway Rogers. Medical Library Assoc., Chicago, Ill., 1965. 306 pp. $6.

The Smithsonian Institution. Walter Karp. Published by Smithsonian Institution, Washington, D.C., in association with the Editors of American Heritage Magazine, New York, 1965. 127 pp. Illus. $2.95.

Smoking, Health, and Personality. H. J. Eysenck. Basic Books, New York, 1965. 166 pp. Illus. $4.95.

Songs of the Yokuts and Paiutes. Alfred Pietroforte. Naturegraph Publishers, Healdsburg, Calif., 1965. 64 pp. Illus. Paper, $1.50; cloth, $3.50.

A Theatre of Machines. A. G. Keller. Macmillan, New York, 1965. 121 pp. Illus. $6.

Three Theories of Child Development. Henry W. Maier. Harper and Row, New York, 1965. 332 pp. Illus. $6.75.

The Viruses. Helena Curtis. Published for the American Museum of Natural History by the Natural History Press, Garden City, N.Y., 1965. 238 pp. Illus. $4.95.

Voices from the Sky: Previews of the Coming Space Age. Arthur C. Clarke. Harper and Row, New York, 1965. 251 pp. $3.95.

Biological and Medical Sciences

Advances in Lipid Research. vol. 3. Rodolfo Paoletti and David Kritchevsky, Eds. Academic Press, New York, 1965. 277 pp. Illus. $13. Six papers: "The metabolism of polyenoic fatty acids" by E. Klenk; "The analysis of human serum lipoprotein distributions" by Alicia M. Ewing, Norman K. Freeman, and Frank T. Lindgren; "Factors affecting lipoprotein metabolism" by Angelo M. Scanu; "The action of drugs on phospholipid metabolism" by G. B. Ansell; "Brain sterol metabolism" by A. N. Davison; and "Lipases" by E. D. Wills.

The African Genera of Acridoidea. V. M. Dirsh. Published for the Anti-Locust Research Centre by Cambridge Univ. Press, New York, 1965. 593 pp. Illus. $37.50.

Anatomy and Physiology of Farm Animals. R. D. Frandson. Lea and Febiger, Philadelphia, 1965. 501 pp. Illus. $12.59.

Atlas of Descriptive Histology. Edward J. Reith and Michael H. Ross. Harper and Row, New York, 1965. 222 pp. Illus. $8.50.

Avian Physiology. Paul D. Sturkie. Cornell Univ. Press, Ithaca, N.Y., ed. 2, 1965. 796 pp. Illus. $15.

Basic Bacteriology: Its Biological and Chemical Background. Carl Lamanna and M. Frank Mallette. Williams and Wilkins, Baltimore, ed. 3, 1965. 1015 pp. Illus. $17.50.

The Bats of West Africa. D. R. Rosevear. British Museum (Natural History), London, 1965. 436 pp. Illus. £7 15s.

The Beetles of the Pacific Northwest. Pt. 4, *Macrodactyles, Palpicornes, and Heteromera.* Melville H. Hatch. Univ. of Washington Press, Seattle, 1965. 278 pp. Illus. $10. Univ. of Washington Publications in Biology, vol. 16. The contributors are David V. Miller, David V. McCorkle, Floyd Werner, and Dennis W. Boddy.

Biochemistry. S. P. Datta and J. H. Ottaway. Williams and Wilkins, Baltimore, 1965. 387 pp. Illus. $6.75.

Biogeography and Ecology in Antarctica. J. van Mieghem and P. van Oye, Eds. Junk, The Hague, Netherlands, 1965. 790 pp. Illus. $31.95. Monographiae Biologicae Series, vol. 5, edited by W. W. Weisbach and P. van Oye. Eighteen papers.

Biological Science: Interaction of Experiments and Ideas. Biological Sciences Curriculum Study, second course. Prentice-Hall, Englewood Cliffs, N.J., 1965. 447 pp. Illus. $5.96 (teachers edition, 479 pp. $6.84).

Cell K. Roderick P. Kernan. Butterworth, Washington, D.C., 1965. 160 pp. Illus. $5.75. Molecular Biology and Medicine Series, edited by E. Edward Brittar.

Comparative Vertebrate Anatomy. Coleman J. Goin and Olive B. Goin. Barnes and Noble, New York, 1965. 256 pp. Illus. Paper, $1.75. College Outline Series.

Electroanalytical Methods in Biochemistry. William C. Purdy. McGraw-Hill, New York, 1965. 368 pp. Illus. $12.50.

Exploration Medicine: Being a Practical Guide for Those Going on Expedi-

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