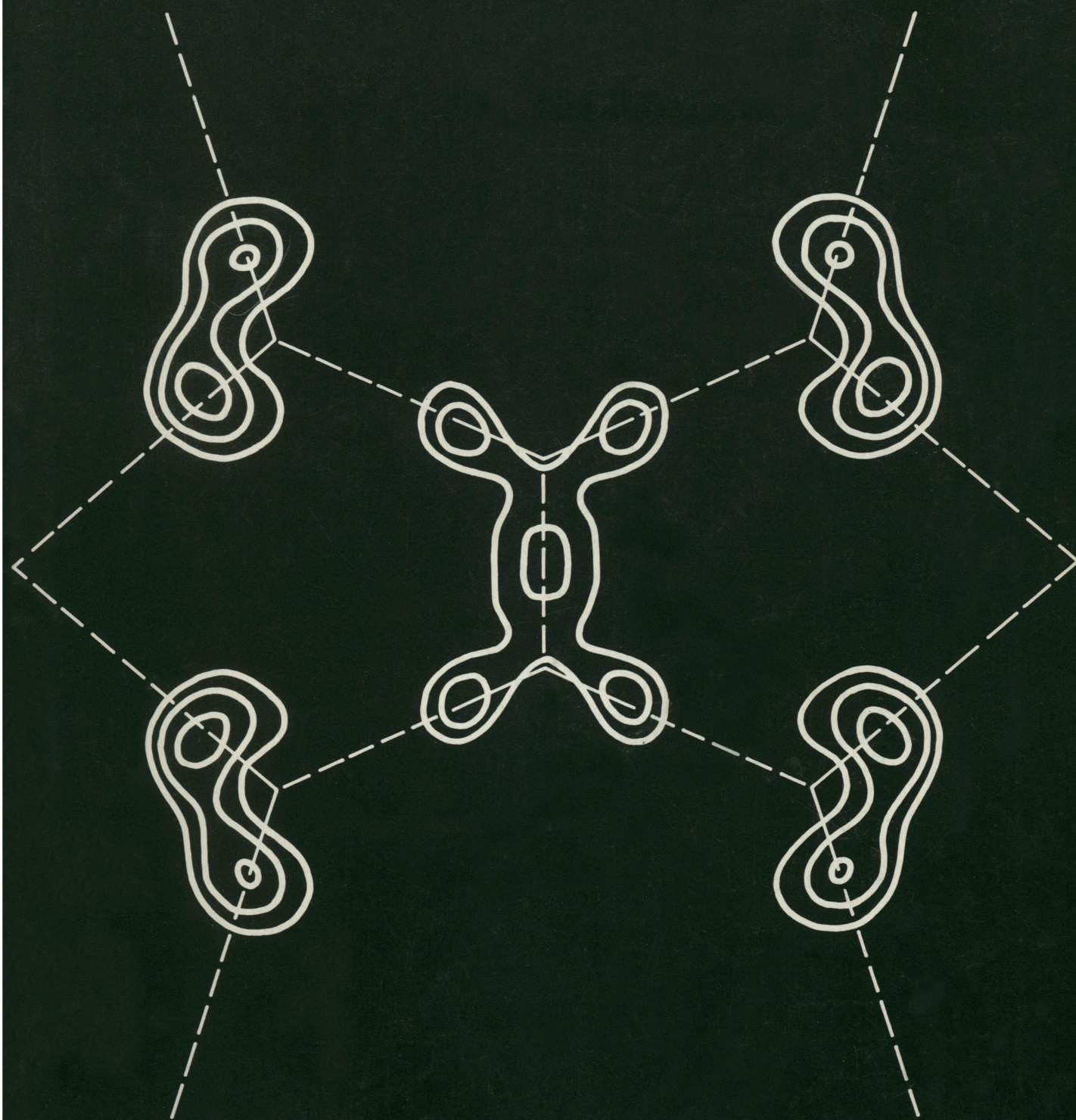


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10 October 1975

Volume 190, No. 4210

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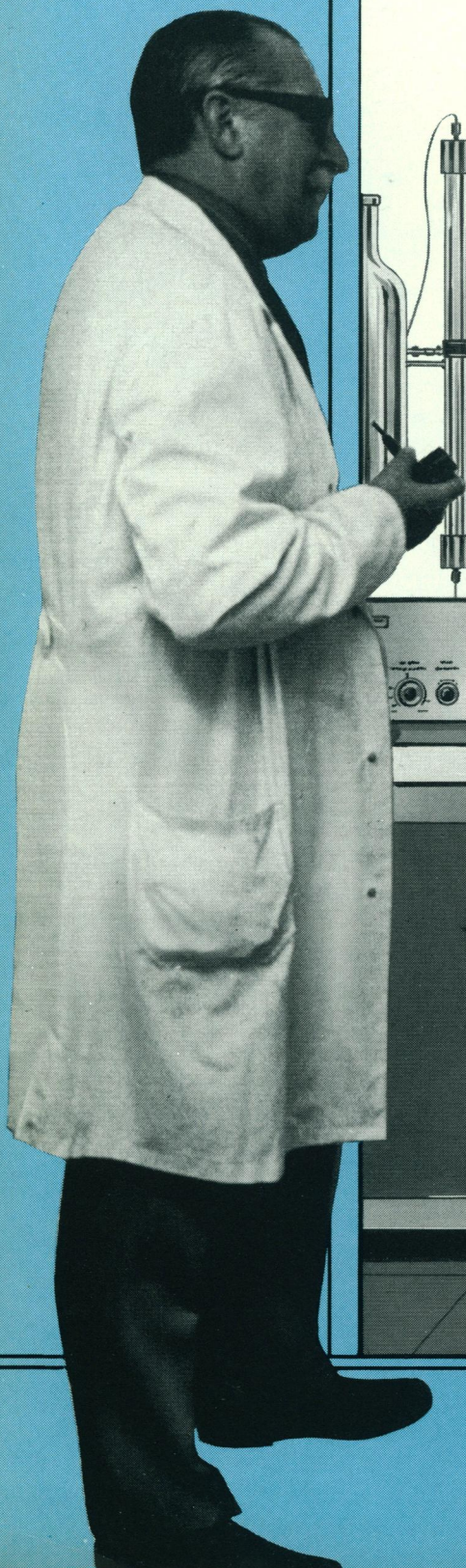
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Portions of a difference map for the $H_{13}O_6^+$ ion and the surrounding C_1^- ions showing the electron density associated with the hydrogen atoms. Contours are drawn at 0.2, 0.3, and 0.4 electron/ \AA^3 . See page 151. [R. A. Bell *et al.*, California Institute of Technology, Pasadena, California]

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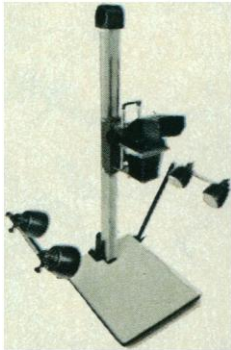
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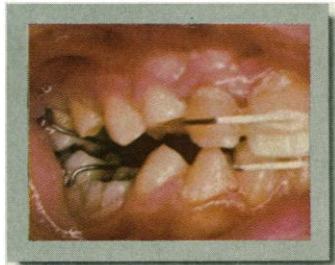
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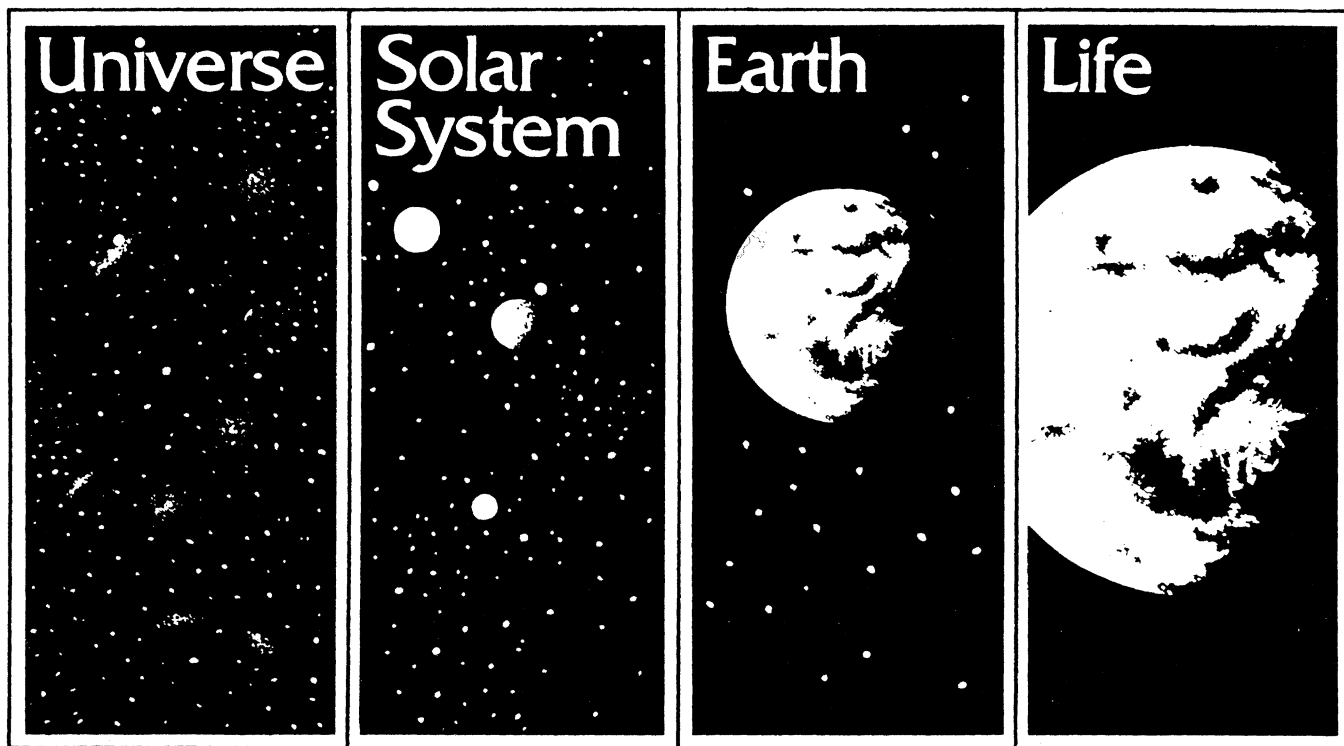
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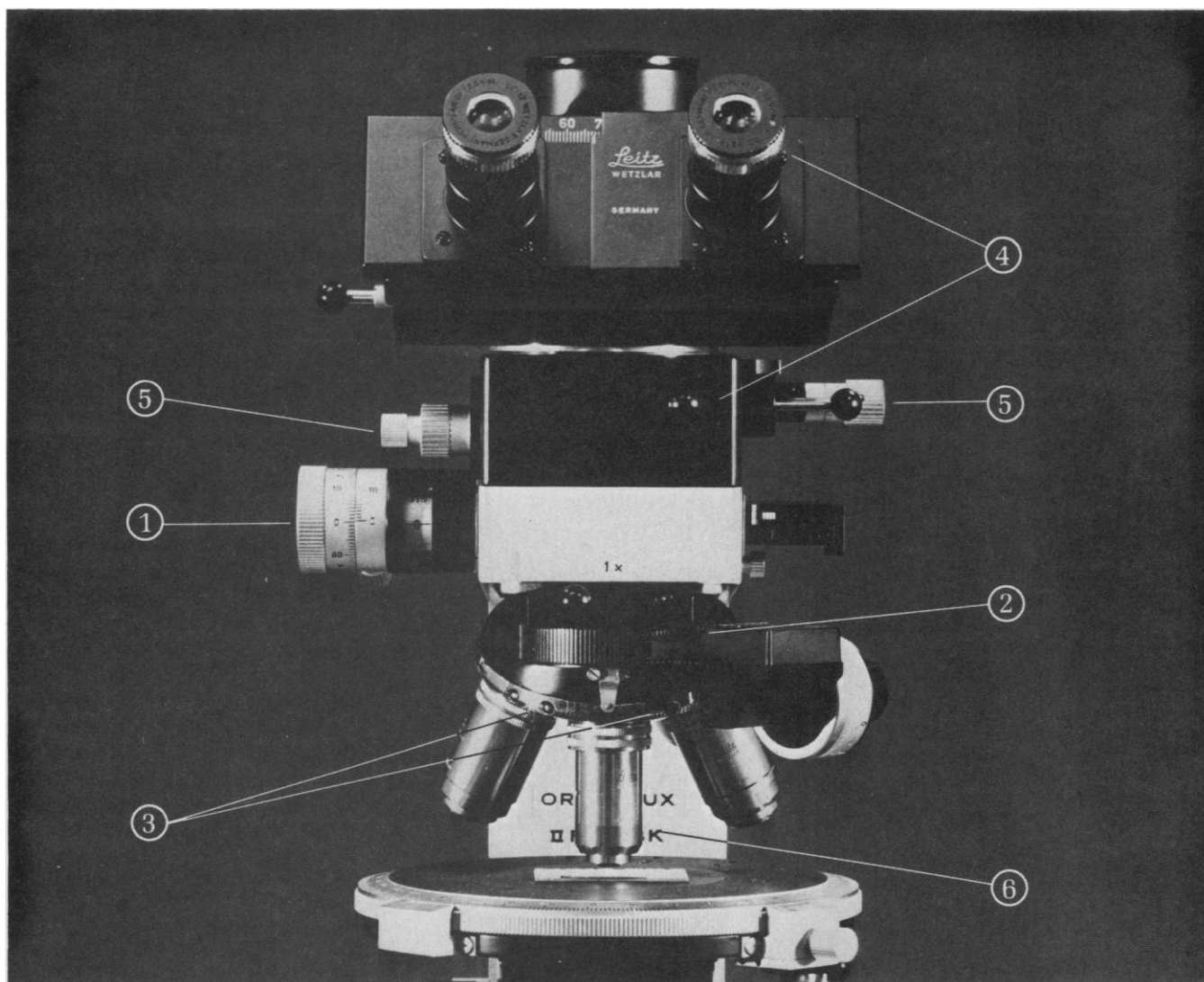


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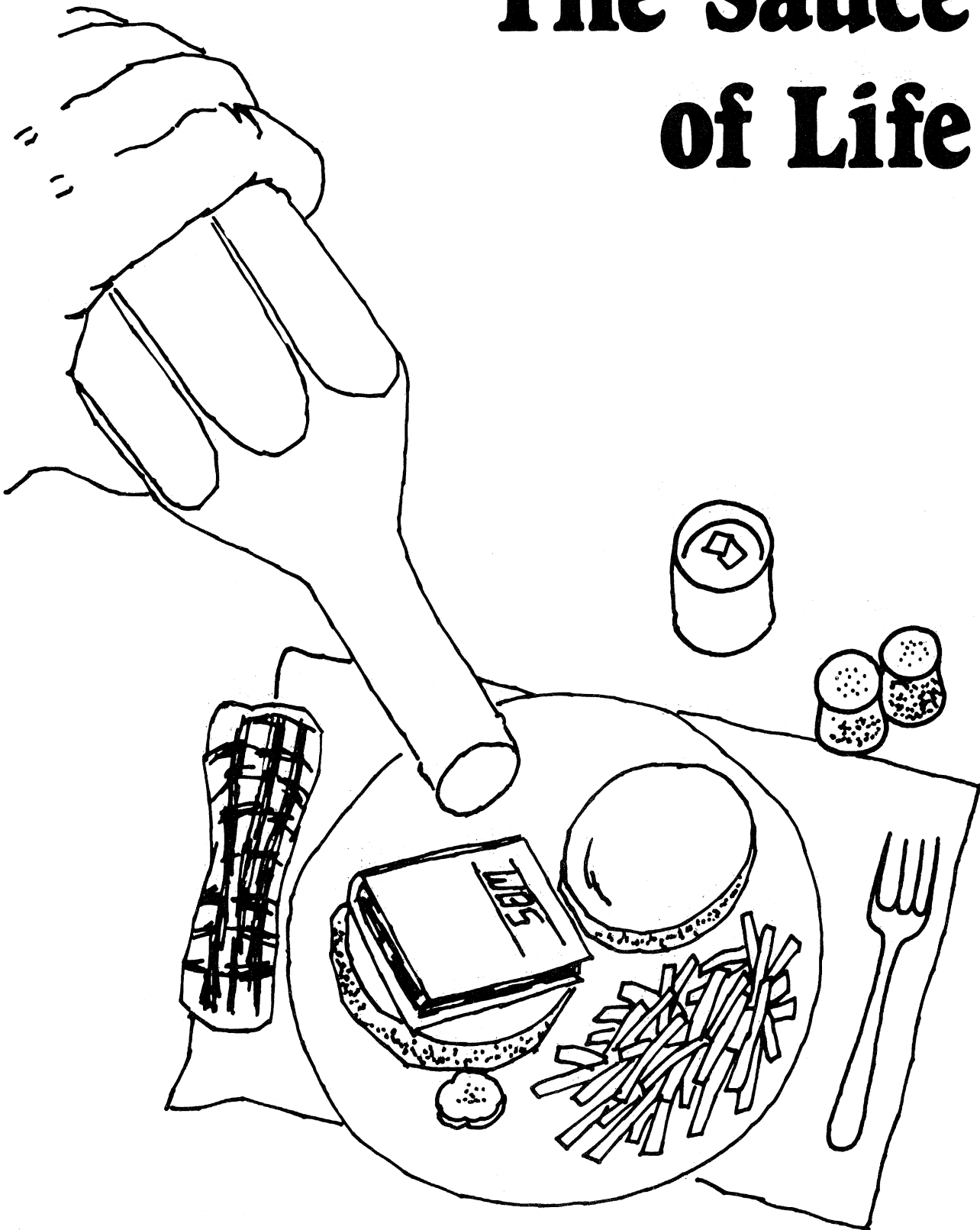
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LETTERS

Organic Farming Methods

The *Science* article by Nicholas Wade, "Boost for credit rating of organic farmers" (5 Sept., p. 777), accurately reflects the content of the report (1) of the Center for the Biology of Natural Systems (CBNS) of Washington University, St. Louis. However, because of the way the report is presented, I would expect a high proportion of readers to misinterpret it with respect to the most fundamental points. All of the comparisons between organic and conventional farms are on a *per acre basis*. The only valid comparison is on a whole-farm basis, inasmuch as the researchers report that the quality of soil and numbers of livestock are similar. I note that the organic farms had 14 more total acres (476 versus 462) but harvested 92 fewer acres of cropland (266 versus 358). Using the report's figures on crop production returns [table 9 in (1), p. 40], I calculate the total for the average organic farm to be \$35,644 (\$134 per acre \times 266 acres) compared to \$46,256 (\$132 \times 358 acres) for conventional farms. This is about 30 percent more for conventional farms on 2 percent fewer acres per farm, which translates into slightly more than 30 percent more food being produced on conventional farms.

The CBNS report contains a single sentence (1, p. 50) which recognizes the deficiency, but few persons are likely to catch its significance: "But because the crops produced on both samples of farms are primarily livestock feeds, not food, a study of the total output (crops and livestock) of both kinds of farms would be needed to determine the actual contribution of each kind to total food production." The same concept is recognized indirectly in item 6 (1, p. 55): "A thorough assessment of how the total level of food production would be affected if there were an appreciable degree of adoption of organic methods." Inasmuch as the authors indicate that livestock are similar in the two systems, it seems unlikely that a study of total farm production would alter my economic analysis to any great extent. Such might not be the case if there were substantial differences in the amount of "feed purchases or sales to balance crops and livestock" (1, p. 13). No data on this matter are presented.

The CBNS report states that most of the additional costs on conventional farms is for fertilizers. A difference in nitrogen requirements is the only valid difference between the two systems in fertilizer costs. The authors make a gross error when they include an additional charge for phosphorus and potassium for conven-

tional farms. An equal charge should be made against organic farms because, unless supplemented by off-farm sources of phosphorus and potassium, organic farm soils will gradually be depleted of these important elements.

The point made above also applies to the CBNS comparison of energy intensiveness. Related to the fertilizer comparison is the use of rock phosphate (energy intensiveness of 0.19 million Btu's) on organic farms versus triplesuperphosphate (energy intensiveness, 0.67 million Btu's) on conventional farms. Based upon many years of research, we expect 3 to 4 pounds of phosphorus in untreated rock to be equivalent to 1 pound in rock that has been acidulated to break the apatite bond. This is a generalized ratio that is adjusted for soil pH, type of crop, and soil test level. The failure to recognize the difference in utility of the phosphorus in rock versus triplesuperphosphate unfairly penalizes the conventional system.

In relation to the additional costs on conventional farms attributed by CBNS mainly to fertilizers, I think it significant that the difference would have been much less had the comparison been made in any of the previous 20 years.

SAMUEL R. ALDRICH

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Excess Bladder Cancer in Beauticians?

The scientific literature is replete with instances of misstatements and oversimplifications in secondary sources becoming accepted as fact. A recent example occurs in a review article on "Cancer of the urinary tract" (1), in which the following statement occurs in the course of a discussion of bladder cancer: "The Leeds, New York, and New Orleans series all noted an excess of hairdressers and beauticians, who, as indicated by Williams (1962), might have had exposure to dye-stuffs" (1, p. 321).

In fact, this conclusion is hardly supported by reference to the three original papers.

1) The Leeds study (2) reports an excess in incidence of bladder cancer among "male hairdressers" (the English term



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"hairdresser" translates to "barber" in the American language—a total of 5 cases versus an "expected" value of 1.8. For female hairdressers, the observed number was 0, the expected value, 0.6.

2) In the New York study (3), the 70 female bladder cancer patients included *one* beautician; there were also four male hairdressers among the 300 men. In their conclusions, the authors state "Also under suspicion are painting, hairdressing, certain textile operations, coal mining, and perhaps plumbing; there is possible ex-

posure to dye in the first 3 occupations" (3, p. 1405). The statement implies that male hairdressers practice hair coloring, which is not common practice in this country.

3) The New Orleans study (4) does not refer to hairdressers or beauticians at all; it speaks only of barbers. It concludes that the comparatively small difference between the number of cancer patients (five) and control patients (two) may have been due to chance only.

The misstatement dissected above may seem trivial. However, in the current con-

troversy on hair dyes, it has been cited in the public press (5, 6) as raising questions concerning the safety of these dyes. One of the articles (5) has, in fact, been dignified by double inclusion in the *Congressional Record* (7).

Two points in conclusion: First, a report (8) on a recent epidemiological study in Massachusetts concludes, "Although suggested by earlier studies [presumably those just discussed] no excess risk was found for . . . [female] hairdressers (one observed, 0.9 expected)." Second, even if beauticians had been observed to incur excess bladder cancer, there would be no justification for linking this to exposure to hair dyes. Tests in which the skin of animals was painted throughout their lifetime with dye composites (9) and numerous skin painting and feeding studies in which single ingredients of dyes were tested have shown no such association.

JOHN MENKART

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Succulent Stalks

So, that's what does it! Robert H. White ["Occurrence of S-methyl thioesters in urines of humans after they have eaten asparagus" (5 Sept., p. 810)] should now guide his research to a really meaningful conclusion by attempting to establish a correlation between asparagus quality and urine odor specificity, something many an asparagus devotee can do without the benefit of laboratory facilities. (One friend goes so far as to insist that the effect is modulated by the vintage of the companion wine.)

I, for one, choose to remain unconvinced. The uniqueness of the succulent stalks must be due to a certain wonderful and mysterious magic, not to some substance with a name I can't pronounce.

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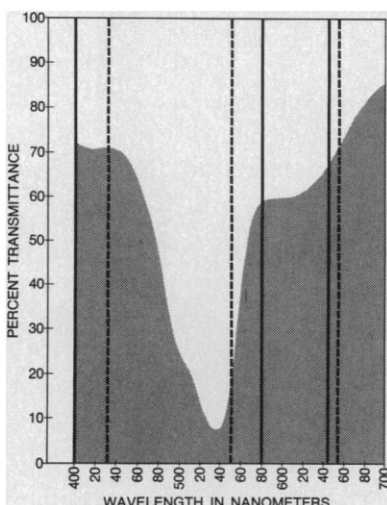
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A comparison of film sensitivities with the spectral transmittance of H & E stain. Vertical lines are peak-wavelength sensitivities of KODACHROME II Professional Film (Type A [solid lines]) and KODAK Photomicrography Color Film 2483 (dashed lines). The spectral-absorption curve is from hematoxylin and eosin stain on a 5-micrometer section of adult guinea pig liver, read on a General Electric Recording Spectrophotometer.

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Grade Inflation

College transcripts are becoming so crowded with A's and B's that chapters of Phi Beta Kappa are reported to be raising the minimum grade average required, to safeguard the honor society's traditional exclusivity. A case study of grades in one community college found that the proportion of the school's students receiving an A in the first semester rose from 9.7 percent in 1963-1964 to 12 percent in 1968-1969 and 21 percent in 1971-1972. A 1974 study of recent grading procedures in 544 colleges across the country found that a student receiving a poor grade can often take the course over. This held for any grade in 303 colleges, for D or F in 442, and for F alone in 295 out of the 544 schools. In 325 of the institutions studied, when a course was repeated, only the last grade was taken into account in computing the grade point average.

Grade inflation makes *no* sense in terms of either of the two prevalent positions toward grades, the progressive or the traditional. According to the progressive view, grades are at best unnecessary, at worst harmful. Students should study because of their interest in the subject, its value for their future career, or not study at all. Progressives argue that under the grading system students are treated like Pavlovian dogs—in need of frequent "reinforcement." Feedback, not reinforcement, is what the student needs. Teachers should write a detailed, thoughtful commentary on each paper or exam. The teacher's response to the student's work should be part of an ongoing educational process, not merely "a good grade on the final." In short, grading is degrading.

The traditional viewpoint is that to expect learning to be its own reward is to expect too much. While a student who loves a subject is likely to continue to love it and perform accordingly whether his work is assessed by a grade or through a written progress report, other students, to whom the subject matter is like a medicine that must be gotten down, or is a necessary step in a career ladder, need something extrinsic to encourage good performance. This is not just a concession to human nature; it is seen as valuable training in "life." A student who learns to work hard for a good grade is thought to gain a self-discipline that will later help him adjust to other tasks in the real world which he will dislike but must perform. A student who cannot learn to live with competition over grades, however he ranks, will find the much harsher competitiveness of adult life even more difficult to take. Finally, so long as selecting some people and rejecting others is inherent in many fields of activity, it seems preferable to base the sorting process on an explicit criterion rather than a subjective one. Grades are less subject to favoritism and paternalism than personal evaluations.

Whichever philosophy one subscribes to, neither provides a rationale for the kind of wishy-washy grading now on the increase. It has all the disadvantages of a grade hierarchy with few of its benefits. It does rank and label people, but does not give them clear performance cues. While theoretically a B— can be as clear a signal as an F or a D, and a B+ could eventually take on the meaning of a C, the various letters have just enough cultural and emotional resonance for student after student to be *mis*cued when A's and B's are appearing on nearly every paper. And with the narrowing of the grade range from A to B, the fact that some professors play the full field while others restrict themselves to the limited range heightens the arbitrariness of grading and the difficulties of grade average comparisons.

What is needed is open discussion leading to departmental or faculty-wide resolutions endorsing either a relatively standardized system of meaningful grades or the abolition of all grades—eliminating grade inflation one way or the other. At the least, each department should compile and circulate statistics that would indicate which professors are contributing most to skewing the grading curve upward (for example, that Professor X's grades are two sigmas higher than the department profile). Such publicizing of grade inflation may help to curb it. Meanwhile, neither students who have really earned their high grade averages nor those who have just had "sympathetic" teachers know what they got.—AMITAI ETZIONI, *Department of Sociology, Columbia University*, and *Director, Center for Policy Research, Inc., 475 Riverside Drive, New York 10027*

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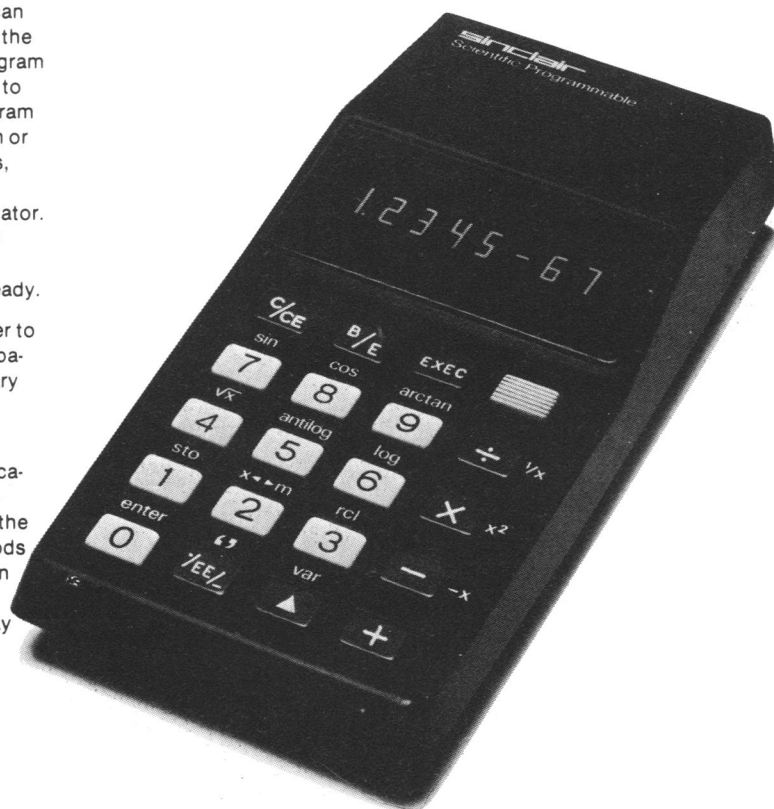
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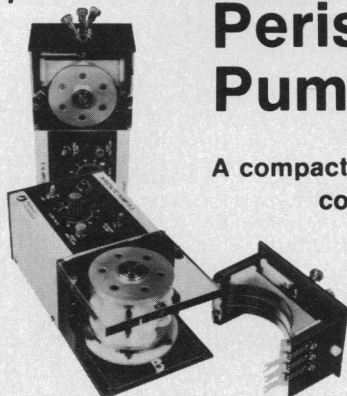
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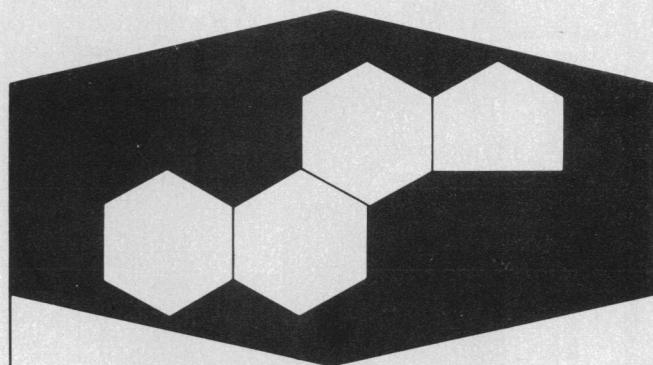
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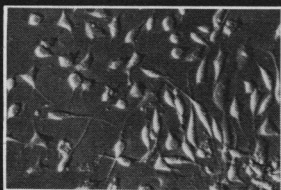


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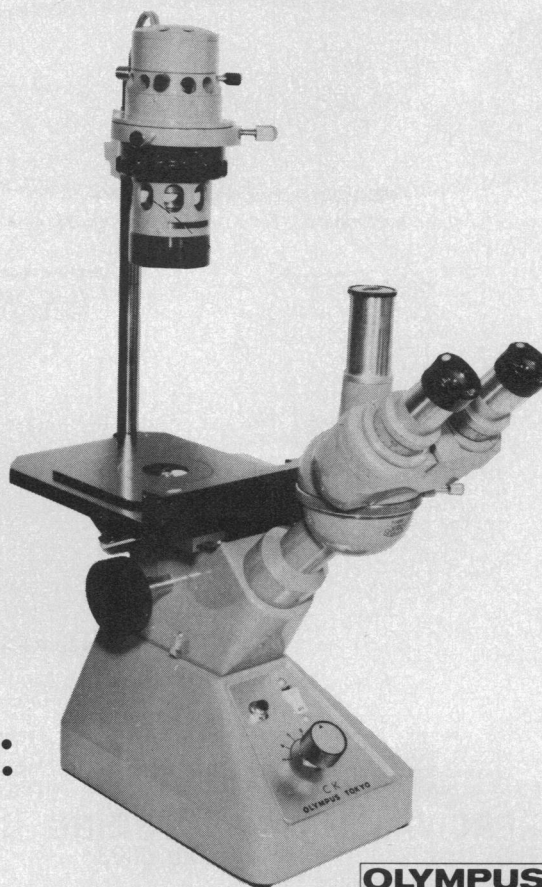
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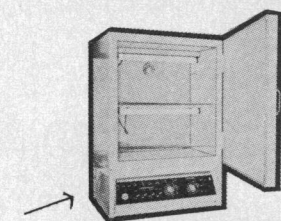
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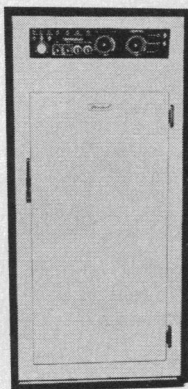


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Where: ϵ represents [1,N⁶-etheno-]

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ϵ Adenosine 5'-phosphate

ϵ Adenosine 5'-diphosphate

ϵ Adenosine 5'-triphosphate

ϵ 2'-Deoxyadenosine 5'-triphosphate

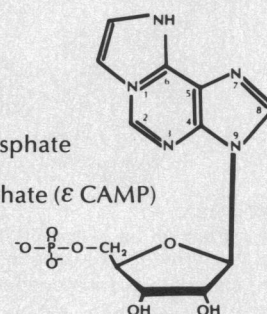
ϵ Adenosine 3',5', cyclic phosphate (ϵ CAMP)

ϵ Coenzyme A

ϵ Acetyl Coenzyme A

ϵ Nicotinamide-Adenine Dinucleotide (NAD)

ϵ AMP Structure Diagram



*The synthesis, properties and applications of these derivatives have been described in a series of articles by Dr. Nelson J. Leonard and associates at the University of Illinois, Urbana (eg. see: *Biochemistry* **11**, 3499 (1972). Write or call for full details:

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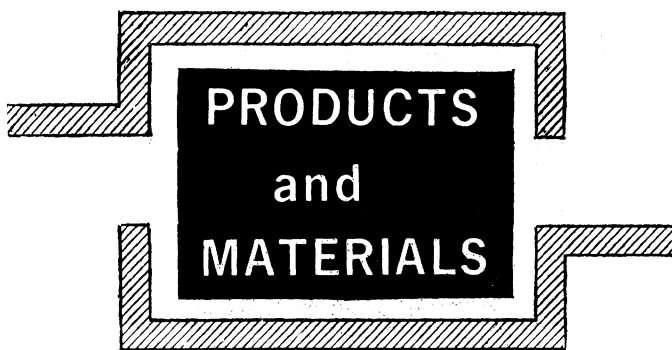
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Revolutionize Current Measurement describes the model 1776 digital current meter including specifications. F. W. Bell. Circle 745.

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Biological Transport. Halvor N. Christensen with contributions by Dale L. Oxender and Gunnar Ronquist. Benjamin, Reading, Mass., ed. 2, 1975. xxii, 514 pp., illus. \$19.50.

A Biologist's Guide to Principles and Techniques of Practical Biochemistry. Bryan L. Williams and Keith Wilson, Eds. Elsevier, New York, 1975. xxii, 256 pp., illus. Paper, \$9.95. A Series of Student Texts in Contemporary Biology.

Biology Laboratory Manual. A. M. Winchester. Brown, Dubuque, Iowa, ed. 5, 1975. x, 348 pp., illus. Spiral bound, \$7.95.

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Communities and Alternatives. An Exploration of the Limits of Planning. Shimon S. Gottschalk. Schenkman, Cambridge, Mass., and Halsted (Wiley), New York, 1975. xx, 170 pp. Cloth, \$9.95; paper, \$5.95.

Competition in the U.S. Energy Industry. Thomas D. Duchesneau. Ballinger (Lippincott), Cambridge, Mass., 1975. xiv, 402 pp. Cloth, \$17.50; paper, \$8.50. A Report to the Energy Policy Project of the Ford Foundation.

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Consciousness and Creativity. Transcending Science, Humanities, and the Arts. Bill Romey. Drawings by Lucretia Romey. Ash Lad Press, Canton, N.Y., 1975. 278 pp. Paper, \$5.



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Handbook of Naturally Occurring Compounds. Vol. 1, Acetogenins, Shikimates, and

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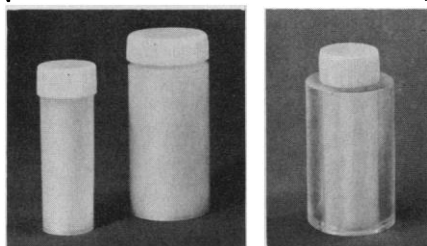
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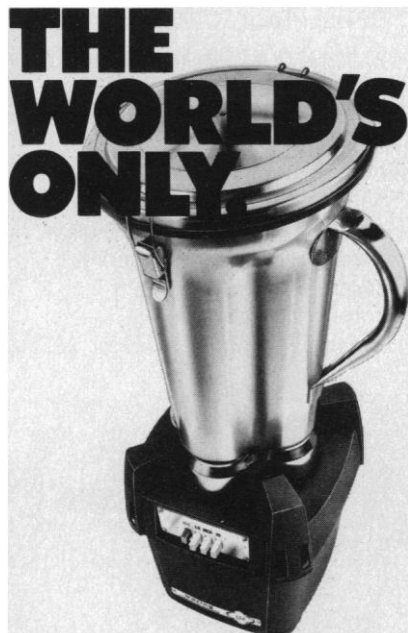
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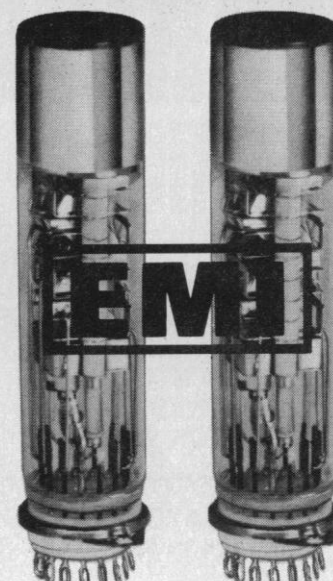
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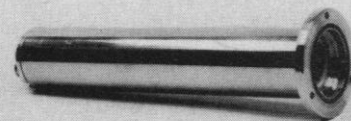
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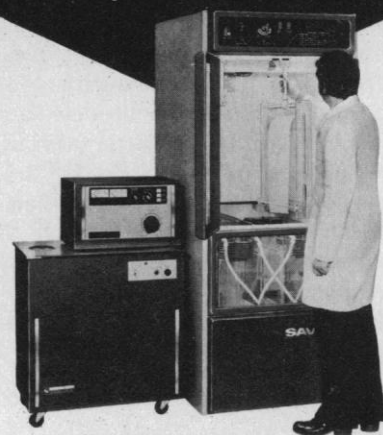
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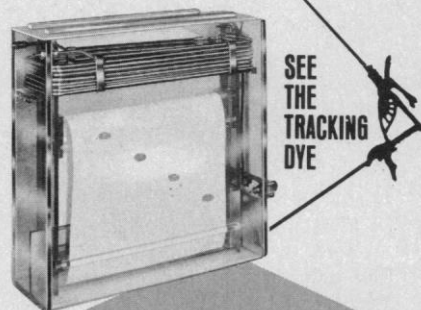
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RESEARCH NEWS


(Continued from page 136)

RNA polymerase—the enzyme that copies DNA into RNA when genes are transcribed. This enzyme is composed of five protein subunits: two copies of α , and one each of β , β' , and σ .

About a year ago, Joel Kirschbaum of the University of Geneva and his associates discovered that a phage carrying genes from the neighborhood of 79 minutes carries genes for RNA polymerase subunits β and β' . Subsequently, Jaskunas and his colleagues found that this phage also carries genes for several ribosome proteins and genes for the three rRNA's. Since they found ribosome genes at 79 minutes, where initially RNA polymerase genes were discovered, Jaskunas and his associates thought it possible that they might find RNA polymerase genes at 64 minutes, where initially ribosome genes were known to be located. Accordingly, they looked for and found the gene for the α subunit on a phage carrying genes from that site.

Jaskunas, Burgess, and Nomura report that not only is the gene for the α subunit of RNA polymerase near genes for ribosome proteins but it is also regulated along with some of those genes. They obtained this result when they isolated a certain deletion mutant of a transducing phage that carries genes for the α subunit and three ribosome proteins, along with other genes. In this mutant phage, the region of bacterial DNA (the promoter) that appears to control the initiation of the transcription of the α gene and these three ribosome protein genes was missing; these four bacterial genes were fused to, and their transcription controlled by, the promoter for phage genes. Genes controlled by this phage promoter are only expressed when bacteria infected by this phage contain no phage repressor (a protein that binds to the DNA and prevents transcription of genes under the control of the phage promoter). Jaskunas and his associates showed that, when bacteria are infected with this mutant phage, the expression of the genes for the α subunit and the three ribosome proteins depends on the presence or absence of the phage repressor.

The evidence that the α gene is regulated along with ribosome protein genes indicates that the synthesis of RNA polymerase, which functions in gene transcription, may be coordinated along with the synthesis of ribosomes, which function in the translation of the genetic code. However, although the β and β' genes are close to ribosome genes at 79 minutes, it remains uncertain whether these genes are regulated with ribosome genes. In fact,



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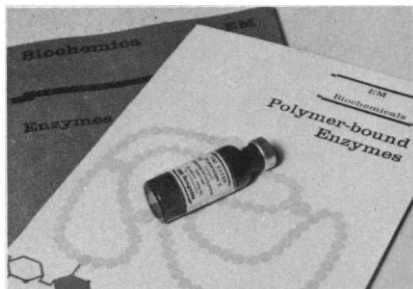
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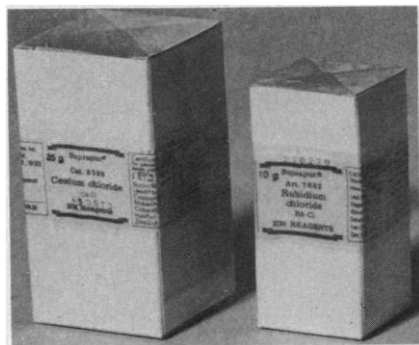
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Burgess points out that there is some evidence that β and β' could be regulated differently than α and that the amounts of β and β' in a cell could be the limiting factors in determining the amount of RNA polymerase. As yet, the location of the gene for the σ subunit of RNA polymerase is not known.

Since genes for the α , β , and β' subunits of RNA polymerase are all found near ribosome genes, it is possible that the gene for the σ subunit is also near ribosome genes. The genes located at 64 and 79 minutes account for only about 70 percent of the ribosome protein genes in *E. coli*. Thus ribosome genes must be located elsewhere on *E. coli* DNA. At least one gene for a ribosome protein is known to be located at 84 minutes, and investigators suspect other such genes may be located between zero and 10 minutes. Near one of these other sites of ribosome genes, the gene for the σ subunit may be found. If the σ gene is also near ribosome genes, the possibility becomes more likely that the synthesis of ribosomes, which function in the translation of genetic messages, is coordinated with the synthesis of RNA polymerase, which functions in the transcription of genetic messages.

In addition to genes for RNA polymerase, other genes whose products are involved in gene expression are clustered with ribosome genes at 64 minutes and 79 minutes. Jaskunas, Burgess, Lindahl, and Nomura find that the phage that carries genes from 79 minutes, including genes for the β and β' subunits of RNA polymerase and several ribosome proteins and rRNA genes, also carries a gene for a protein (elongation factor EF-Tu) used to transport transfer RNA (tRNA) molecules carrying amino acids to their proper positions on ribosomes.

A phage that carries the α gene and genes for 30 ribosome proteins located in the neighborhood of 64 minutes also carries another gene for EF-Tu and a gene for a different elongation factor—EF-G—that moves the ribosome along the mRNA as the genetic message is translated. Although it is not carried by this transducing phage, a gene coding for another protein used in gene expression—CRP—is also located around 64 minutes. A few years ago, Robert Perlman, Ira Pastan, and their colleagues, then working together at the National Cancer Institute, mapped the position of the CRP gene at about 64 minutes. The CRP gene codes for a protein that binds 3',5'-adenosine monophosphate and is necessary for the initiation of transcription of a wide variety of genes in bacteria.

Besides providing new insight into the possible coordinated control of RNA po-

lymerase and ribosome synthesis, the identification of genes clustered with ribosome genes on transducing phages is leading to other discoveries that may help explain the molecular biology of protein synthesis. For example, the discovery that there are two genes for elongation factor EF-Tu—one at 64 minutes and the other at 79 minutes—is thought to be significant because few genes in bacteria are present more than once per cell. Burgess speculates that the two genes, generated by gene duplication, may have diverged slightly and thus may not be identical, although they certainly code for very similar proteins. At least three different functions for EF-Tu have been proposed. One function is to aid in protein synthesis. A second is to serve as part of an enzyme involved in the replication of a particular virus. The third is to help stimulate the synthesis of RNA polymerase. It is not known whether all of these functions can be carried out by each of the two EF-Tu's coded by the two genes.

Nomura and Jaskunas suggest another hypothesis to explain why there are two genes for EF-Tu. The gene clusters at 64 minutes and 79 minutes may be physically close in *E. coli* cells because of the way the DNA is folded. The two genes for EF-Tu could be attached to each other to maintain this proximity and, possibly, keep the two clusters of active genes in a position where they can be easily transcribed.

Nomura and his associates, including E. Lund and James Dahlberg, have also discovered that a tRNA gene is located among and transcribed along with rRNA genes at 79 minutes. They speculate that this tRNA may have some additional function in the cell besides its usual role in protein synthesis. For example, it could be involved in the control of rRNA production or ribosome assembly.

Although ribosome genes have been studied for more than a decade, the recent use of transducing phages to investigate these genes has led to the first major advances in understanding how ribosome genes are organized and controlled. And since ribosome genes are adjacent to other genes whose products are crucial to gene expression, studies of ribosome genes may help molecular biologists to understand how the transcription and translation of genetic messages are integrated.

—GINA BARI KOLATA

Additional Reading

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4. P. Dennis and M. Nomura, *ibid.*, **71**, 3819 (1974).
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