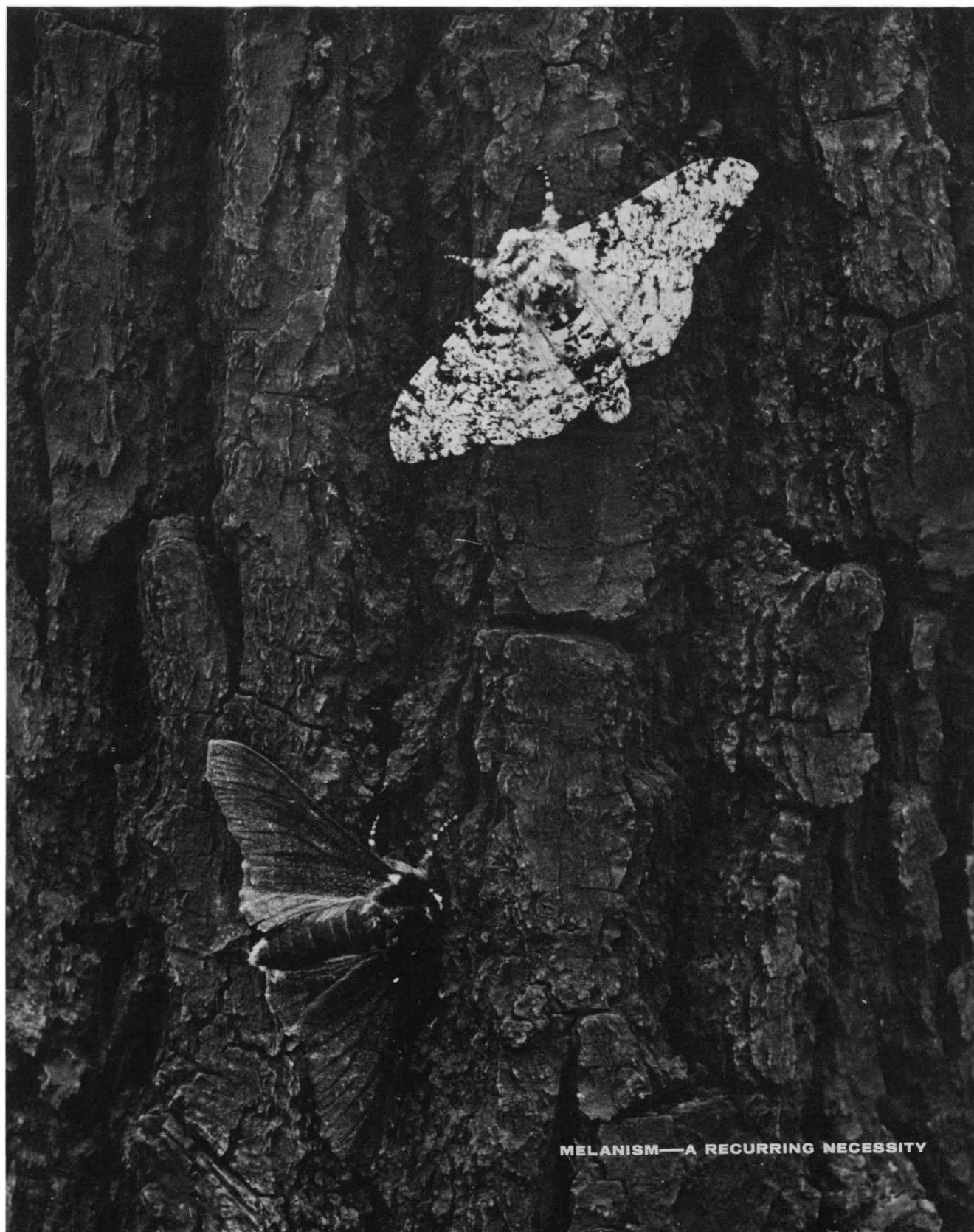


SCIENCE

4 June 1965

Vol. 148, No. 3675

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



MELANISM—A RECURRING NECESSITY

Tales of Restless Nuclei

The molecules in a solid may be tumbling, rotating, or jumping. Or just quietly vibrating. What they do can affect the characteristics of bulk matter. This is not news . . . but the way we can relate specific motions to physical properties *is*.

Physicists at GM Research are using Nuclear Magnetic Resonance (NMR) to study molecular motion as temperature or composition is changed. This new branch of spectroscopy uses magnetic nuclei to probe many phenomena on a molecular scale. From it, for example, our NMR physicists are developing new knowledge of electron densities, molecular configurations, and the basic nature of that strange squishy state of matter—the plastic crystal.

In addition, they are associating specific molecular motions with the macroscopic properties of polymers. And they're learning to predict properties for the engineer.

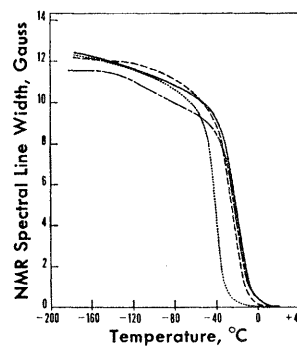
Take neoprene, for instance. Engineers wanted to know what plasticizers might keep it flexible at low temperatures . . . without having to run physical tests on a number of samples.

NMR found out. How? By detecting changes in molecular motion. A hard, solid polymer allows molecules only limited movement. Addition of a plasticizer, or an increase in temperature, allows more complex motions as the rigid structure relaxes. The increased motions cause narrowing of the NMR spectral line which can be correlated with flexibility.

The motions of the nuclei tell the tale . . . and help General Motors find a better way.

General Motors Research Laboratories

Warren, Michigan



Effects of plasticizers on NMR spectrum of neoprene. The best plasticizer produces spectral line narrowing (due to increased molecular motion) at lowest temperature.
—From a recently published GMR paper.

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All definitions are worded to maximize rapid understanding. Pronunciation is clearly indicated. Anatomical terms are now organized so that you will find the full definition under the first word you check or the first term to which you are referred. The latest *Nomina Anatomica* term carries the main entry. Consistent NA terminology is a hallmark of this edition.

Hundreds of drug names have been added. Common drugs are entered under generic and proprietary names, with brief statements on structure, action and use in the generic listing. Entries in microbiology, hematology, and dermatology have been particularly reworked for accuracy and timeliness.

Several hundreds of new illustrations have been added; many existing ones have been redrawn. The addition of many electron photomicrographs is notable. Valuable tables list chemical elements, stains and staining methods, weights and measures, etc. A concise section on "how to use the dictionary" clearly explains entry arrangements, alphabetization, etymology, pronunciation, etc. A new, more durable paper has been utilized for this edition. The highly legible type face has been retained, along with flexible binding and thumb-indexing.

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*Results of a monumental project reporting
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CAROLYN W. SHERIF, Ph.D., Research Associate, and MUZAHER SHERIF, Ph.D., Director and Research Professor, Institute of Group Relations; and ROGER E. NEBERGALL, Ph.D., Associate Professor, Department of Speech, All at the University of Oklahoma. 264 pages, 6 1/8" x 9 1/4", illustrated. \$8.25.
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Vol. 148, No. 3675

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The American Association for the Advancement of Science was founded in 1848 and incorporated in 1974. Its objects are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

COVER

Melanism in insects inhabiting industrial environments is one of the most striking evolutionary changes occurring today. Extensive investigations of *Biston (Amphidasys) betularia* (peppered moth) reveal that its black form, *carbonaria*, may constitute up to 98 percent of industrial populations. The black form has a 30-percent chance of survival over *f. typica* on blackened tree trunks. A mechanism may exist in the gene complex, and may insure dominance of the black form at each mutation. See page 1290. [H. B. D. Kettlewell, University of Oxford]

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- correlation analysis
- multiple linear regression
- polynomial regression
- canonical correlation
- factor analysis (principal components, varimax)
- discriminant analysis (many groups)
- time series analysis
- data screening and analysis
- non-parametric tests
- random number generation (uniform, normal)

In matrix manipulation:

- inversion
- eigenvalues and eigenvectors (real symmetric case)
- simultaneous linear algebraic equations
- transposition
- matrix arithmetic (addition, product, etc.)
- partitioning

- tabulation and sorting of rows or columns
- elementary operations on rows or columns

In other mathematical areas:

- integration of given or tabulated functions (Runge-Kutta)
- integration of up to six first order differential equations (Runge-Kutta)
- Fourier analysis of given or tabulated functions
- Bessel and modified Bessel function evaluation
- gamma function evaluation
- Legendre polynomial evaluation
- elliptic, exponential, sine, cosine, Fresnel integrals
- finding real roots of a given function
- finding real and complex roots of real polynomial equations
- polynomial arithmetic (addition, division, etc.)
- polynomial evaluation, integration, differentiation

These new subroutines will help in every area of industry and science.

Correlation analysis, multiple regression, factor analysis, and data screening and analysis are standard tools for research in medicine, biology, psychology and like fields.

In colleges and universities, faculty members and students will get better use of their computation center with a minimum of programming time.

In the process industries, these new subroutines will speed up analysis of operating data, quality control, design of petroleum and chemical units, simulation of units, plants and processes, and laboratory analysis.

In the aerospace industry, the programs will help in system design and analysis, data reduction and analysis, data acquisition and control, and system simulation and evaluation.

Whatever industry you're in, your job becomes a little easier.

...Mathematical Programming System/360 gives you powerful mathematical optimization capabilities

This new system combines the best features of current IBM linear programming systems with significant new capabilities including MARVEL, a new language processor for matrix generation, solution analysis, management reporting and file maintenance. Modular design makes it easy to incorporate new optimization techniques, as they are developed, hence the name Mathematical Programming System/360.

- Maximum problem size of 4,095 rows.
- The system utilizes the Revised Simplex (product form of inverse) Method with bounded variables and range constraints.
- A highly efficient inversion technique using a triangularization method permits inversion to be made frequently, thus increasing the speed of succeeding iterations and maintaining a high degree of accuracy.
- Multiple pricing method, adjusted for problem size and amount of available storage, reduces the amount of file processing and increases solution speed.
- A "cycle" facility which reduces solution time for problems containing many more columns than rows.
- Dynamic storage allocation provides for maximum use of available storage.
- The control language includes conditional control statements which permit alternate solution strategies to be implemented depending upon the conditions which arise during solution.
- Interrupt facilities provide the means for preplanning alternate strategies in the event of off-normal conditions.

- Simultaneous parametric programming on both the right-hand side and the objective function may be used.
- A single language (MARVEL) is used to specify the file processing functions needed for mathematical programming applications.
- Specialized matrix generators and report writers can be written in the MARVEL language.
- Modular design makes it easy to add, modify, replace or delete functions as new requirements develop.

The MARVEL language allows you to prepare printed reports in final form with easily written programs which may perform mathematical operations, re-ordering, selection and analysis while the report is being prepared. The flexible input and output facilities coupled with the capacity to communicate directly with the mathematical programming procedures provide the user with a powerful management report writing system.

The MARVEL language also contains a complete set of operations to produce, select, and maintain data files associated with mathematical programming problems. By using the selection and maintenance features of the MARVEL language, the user can produce new data files (matrix generation) from one or more data sources. These new data files may: consist of data to be input to user programs; be filed as partially processed data; or, define a new mathematical programming problem.

While unknown only 20 years ago, linear programming techniques are now being used to cut costs in applications like aluminum alloy blending, gasoline blending, ice cream mixing, meat packing, electric arc furnace steel making, blast furnace burdening, production planning and a whole range of marketing problems.

...Project Management System/360

This advanced, modular program provides critical path scheduling, PERT, and PERT/COST capabilities. Its building block design under monitor control insures flexibility for incorporating additional functions and adaptability to special customer requirements, so that both customers and IBM can add such functions at a later date.

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In service industries: network techniques to schedule freight forwarding operations, terminal and service facilities, power plant operations, bank clearinghouse operations, dividend check distribution, insurance report preparation, judicial functions, urban development.

In Federal agencies: PERT and PERT/COST are used for internal management control as well as for contractor control.

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of legal redress were not utilized. And, while the actions of the demonstrators were shocking, even more shocking was the inept handling of the situation by the university administration.

Although many of the statements in the Langer report can be challenged, certain of those in part II are most misleading. To say that "it is only Berkeley that has placed the university as a whole in a position of leadership in American higher education" does a disservice to the other campuses of the University of California. The majority of students and faculty are located on other campuses, and the implication is that these are inferior to the Berkeley campus. Yet the entry requirements are as stringent at the other campuses as they are at Berkeley. The quality of scientific research is not inferior at these campuses. And certainly neither the teaching nor administration is inferior. The university's great position in higher education is attained in a large measure through its multi-campus concept. Each campus can point to something it offers academically that Berkeley does not. When put together, these make the University of California great. All are an integral part of a single educational system.

The actions of the administration, faculty, and students at the other campuses with respect to this controversy have been admirable and certainly acceptable by community standards. Neither students' rights, education, nor research have been compromised on these campuses. The "tradeoff between . . . student 'beatniks' and . . . academic distinction," to use Langer's phrase, does not seem to be necessary at these campuses. Langer says that many Californians want a "respectable" rather than a great university. I do not know how many; I do know that the majority of Californians would agree on and strive to maintain what we have had in the past: a state university both great and respectable.

RONALD L. KATHREN
14744 Washington Avenue,
San Leandro, California 94578

The Basic Priorities

The articles on the Berkeley "student revolt" constituted excellent coverage of that unhappy situation. Although *Science's* articles touched on the basic problems involved, most of the editorials and news stories I've seen missed the mark by a wide margin.

The American public (including many scientists and educators) evinces an appalling lack of understanding of (i) the aims of education, (ii) the current pressures on students, and (iii) the nature of university administration. Education should encourage all possible freedom of thought, speech, and action that will contribute to the intellectual, moral, and physical growth of the learner. At Berkeley this dictum was forgotten or overlooked by all four groups involved—students, faculty, administrators, and regents. Owing to several factors—such as enormous enrollment increases and plant expansion, emphasis on faculty and graduate research, disregard for undergraduate teaching and guidance, inept administrative and board decisions—pressures on students blew the safety valve.

One solution to the dilemma is for all of us to recognize that each of the four campus-related groups has a specific or primary role. When these roles are reversed, or otherwise mixed up, serious dislocations occur. At the risk of oversimplifying, scholars of higher education have suggested the following basic priorities: Students are on campus to study; faculty members are there to teach; administrators should manage, negotiate, and facilitate; trustees and regents should establish the governing policies. The American public is composed of these four academically related groups, plus hundreds of other interested groups such as parents, alumni, donors, and legislators. Each person in each group can make a significant contribution to the alleviation of such pressures as caused the "revolt" at Berkeley. The first step should be in understanding the dimensions of the three numbered points above. The second step should be the acceptance of a position on these points. The third step should be a willingness to express this position by suggesting appropriate action. Really constructive criticism is in short supply!

This nation is great at least partly because of the education provided its citizens. It should be the responsibility of every citizen to take the steps necessary to insure that our schools, colleges, and universities will continue, if not improve, their important function of educating for freedom, democracy, and justice.

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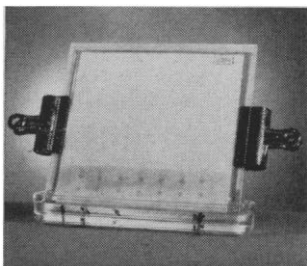
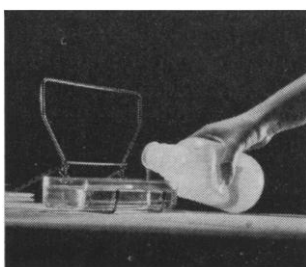
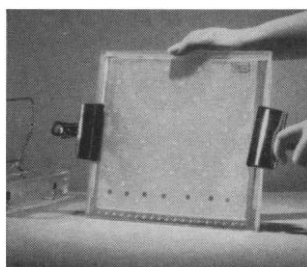
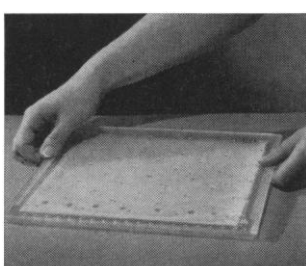
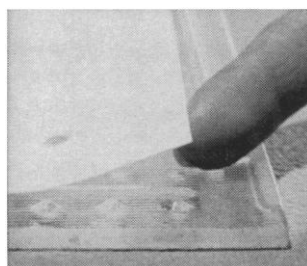
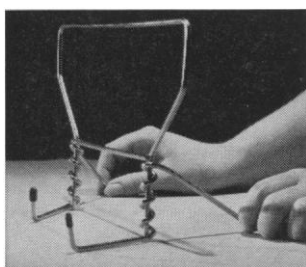
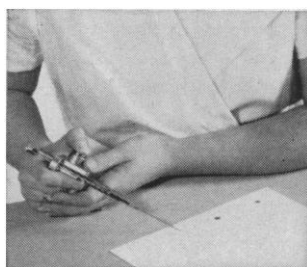
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The chemist's lot eases further

Just before 5 on the afternoon of March 1, 1965 a strong movement toward the ballroom of the Penn-Sheraton was under way. These people must have done their homework by giving careful advance scrutiny to the program of the great Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy. Within the hour, what we had done to thin-layer chromatography was animating conversation in lines waiting for tables in restaurants all over the Golden Triangle.

What we had done was to break the news that EASTMAN CHROMAGRAM Sheet had arrived to take the mess out of TLC by providing silica gel properly coated on a snippable base of poly(ethylene terephthalate). What we had failed to do was to provide a minimal-volume, fast equilibrating chamber in which to develop the stuff. This we are about to put on the market as EASTMAN CHROMAGRAM Developing Apparatus. To minimize delay, place order *now*, along with your order for the sheet. Upon delivery, proceed as follows:



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Lens people



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Science in the State Department

The Department of State's program of sending scientific attachés to major foreign capitals was started early in the 1950's. Promising but on trial at first, faltering and almost dead a few years later, the program has now gained in size, in acceptance, and in responsibility. Scientific officers represent the U.S. in some 15 foreign capitals. To back them up, the Department of State's Office of International Scientific Affairs has grown to include a professional staff of approximately 20. The office here and the attachés abroad serve as bridges between American and foreign scientists; in more than purely scientific ways they exemplify and further a friendly spirit of international cooperation; and they advise the Department of State and our ambassadors on matters in which science and technology are involved. If the amount of work they are called upon to do is a valid measure of acceptance, the program has established its position and usefulness.

How effective a scientific officer can be in a particular situation depends in part upon the ambassador and the other foreign-service officers with whom he works and upon their interest in and knowledge of how to use the services of their scientific colleagues. The Foreign Service Institute of the State Department recently made a contribution to better utilization by conducting a 4-week science seminar that was supported by the Ford Foundation and that gave a number of foreign-affairs practitioners an intensive course on the role of science and technology in foreign relations. A description of the course, by L. F. Audrieth and H. I. Chinn, and the keynote address to the seminar, by James R. Killian, both appear in the May issue of the *Bulletin of the Atomic Scientists*.

The seminar appears to have been productive. And the recent announcement that the name of the office had been expanded to "International Scientific and Technological Affairs" and that the director would have rank and authority equivalent to an Assistant Secretary of State may enhance the prestige of the program. But these changes are not adequate substitutes for filling the top position, which has been vacant since Ragnar Rollefson, the last director, returned to the University of Wisconsin in September. The lack of a scientific director is weakening the State Department's relationships with the community of scientists and engineers and curtailing the ability of the staff to provide the best possible assistance in evaluating the scientific and technological problems that are involved in a widening array of foreign-policy decisions—for example, those dealing with international laboratories, resource development, such cooperative ventures as the study of the Indian Ocean, the technological problems of arms control and monitoring systems, application of science and technology for the benefit of developing nations, or joint arrangements for communication systems, weather reporting, or other technical matters.

Of course the State Department has had other problems to worry about in the past 9 months. Nevertheless, the post of director should be filled without further delay. Still around are a number of people who can remember the situation that arose a decade ago when the top position was allowed to remain vacant; science attachés abroad completed their tours of duty and were not replaced, and the program came almost to a halt. By inaction at that time the Department of State deprived itself of one of its own assets in the conduct of foreign relations. We hope it is not starting on that course again.—DAEL WOLFE

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LABORATORY IDENTIFICATION OF PATHOGENIC FUNGI SIMPLIFIED (2nd Ed., 2nd Ptg.) by **Elizabeth L. Hazen and Frank Curtis Reed**, both of *New York State Department of Health, Albany, N.Y.* Presented in five sections, part of which includes: The Incitants of Dermatophytoses (ringworm)—The Microsporum, Trichophyton, and Epidermophyton; The Deep-Seated or Systemic Fungi; The Contaminants; etc. '64, 164 pp. (7 x 10), 162 il., (*Amer. Lec. Tests and Techniques* edited by Gilbert Dallorf), \$7.50

MICROHEMOCIRCULATION: Observable Variables and Their Biologic Control by **Elio Maggio**, *Univ. of Illinois, Chicago, Ill.* New and original information and photomicrographic evidence concerning the variables of microhemocirculation. Discusses methods of studying the observable variables of microhemocirculation, anatomo-physiologic variables, biologic control of the physiologic variables, pathologic variables, and the part played by microhemocirculation in tissue response to injury. About 344 pp. (6¾ x 9¾), about 93 il. (23 in color), 6 tables. In Press

CYBERNETIC MEDICINE by **Aldo Masturzo**, *Univ. of Naples, Naples, Italy.* Outlines the general principles of cybernetics—as well as the general picture of results achieved as applied to biology and medicine. The author illustrates the importance of the role played by biology, medicine, electronics, engineering, and mathematics in this field . . . and the effectiveness of cybernetic medicine in the field of research carried out on living beings. About 180 pp., about 19 il. (*Amer. Lec. Living Chemistry*). In Press

THE CHEMICAL ORIGIN OF LIFE by **Alexander I. Oparin**, *U.S.S.R. Academy of Sciences, Moscow, U.S.S.R.* Translated from the Russian by **Ann Synge**, *Stonehaven, Scotland.* In this monograph the author describes in as great detail as achievements of contemporary science will allow the three stages in the evolution of organic substances which preceded the appearance of life on Earth. '64, 152 pp., 33 il., (*Amer. Lec. Living Chemistry*), \$6.75

THE DOCTORATE: A Handbook by **George K. Schweitzer**, *Univ. of Tennessee, Knoxville, Tenn.* A practical handbook designed for all holders of doctoral degrees as well as those who come into contact with them professionally and socially. Literally hundreds of questions in regard to the doctorate are answered briefly and concisely . . . questions regarding history, present status, etiquette, and ceremony. '65, 116 pp., 6 il., \$4.75

AMEBIASIS: A BIOMEDICAL PROBLEM by **James G. Shaffer**, *The Lutheran General Hosp., Park Ridge, Ill.*; **William H. Shlaes**, *The Chicago Medical School, Chicago, Ill.*; **Ryle A. Radke**, *Univ. of Washington, Seattle, Wash.* Partial list of topics covered include the complexity of clinical diagnosis and treatment and problems presented by the protean manifestations of the disease; accepted laboratory aids to diagnosis; etc. '65, 192 pp. 86 il. (15 in full color), 12 tables, \$8.50

LIST OF FUNGAL PRODUCTS by **Shoji Shibata**, *Univ. of Tokyo*; and **Shinsaku Natori and Shun-ichi Udagawa**, both of *National Institute of Hygienic Sciences, All of Tokyo, Japan.* Makes available a completely up-to-date list of the structurally established mould metabolites, including their names, structural formulae, sources, and literature. Principal pathways of biosynthesis, as well as the amino acids condensation scheme, are illustrated using appropriate symbols of isotopic labelling. About 178 pp. (7 x 10). In Press

SELECTED HISTOCHEMICAL AND HISTOPATHOLOGICAL METHODS by **Samuel Wesley Thompson**. With two chapters contributed by **Ronald D. Hunt**. Both of *Fitzsimons General Hospital, Denver, Colo.* Several methods are presented for most tissue components, of man and animals demonstrable histochemically. With each method is detailed information as to applications of the method, fixatives or special preparations to be used, special equipment required, etc. About 1,492 pp. (7 x 10), about 401 il. In Press

BOUND WATER IN BIOLOGICAL INTEGRITY by **S. J. Webb**, *Univ. of Saskatchewan, Saskatoon, Canada.* Concerned with the role of bound water in determining the response of cells to desiccation and irradiation from ultraviolet, visible light, and x-rays. The author shows by utilizing the aerosol to control drying that the behavior of several species of bacteria and viruses is strongly dependent on their bound water content. About 222 pp., about 42 il., 30 tables. In Press

VISION: Biophysics and Biochemistry of the Retinal Photoreceptors by **Jerome J. Wolken**, *Carnegie Institute of Technology, Pittsburgh, Pa.* The approach is phylogenetic . . . beginning with the primitive protozoan light-detecting receptor structures and comparing them with the image-forming compound eyes of the invertebrates—insects, crustacea, and molluscs—and with the retinal photoreceptors of the vertebrate eye of man. About 232 pp., about 154 il., 9 tables, (*Amer. Lec. Living Chemistry*). In Press

A NEW PROTOZOON: Its Relation to Malignant and Other Diseases by **Roger Wyburn-Mason**, *Hounslow Hosp., Hounslow, England.* The author describes a new method—employing the property of thermotaxis possessed by many parasites—by which he has succeeded in persuading a new organism to migrate alive and free of other cells from various tumors and tissues. Well documented by seventy-three case histories and nearly 500 references. '64, 142 pp. (7 x 10), 40 il., \$6.75

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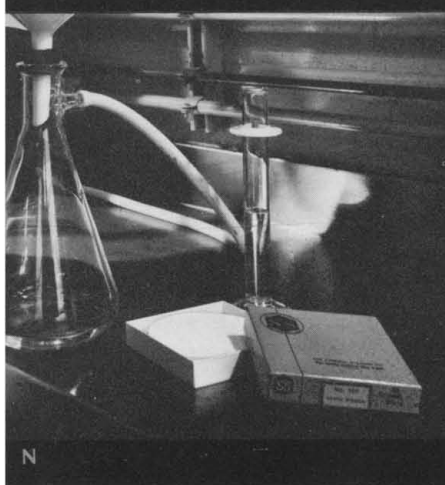
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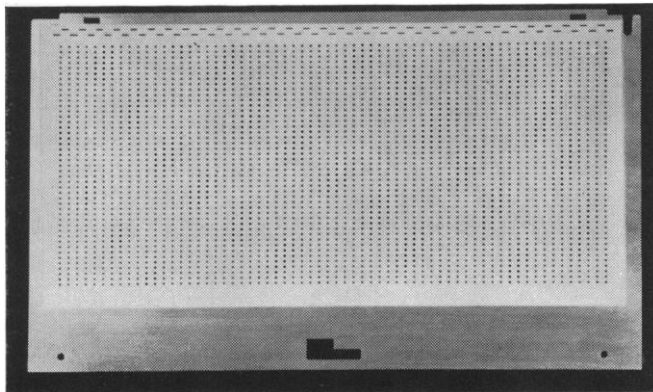
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B. G. Hemmendinger examines one of the digital circuit packages used in the central control unit of the new Electronic Switching System developed at Bell Laboratories. In these circuits, logic functions such as AND, OR, and AND-OR are built up with various combinations of a basic AND-NOT gate. About 27,000 transistors and 90,000 diodes are used in two duplicated central control units for one electronic central office.



Stored-program control— flexibility for telephone switching systems

Modern systems that switch your telephone calls use complex control equipment to operate the switches that make telephone connections. Such "common control" equipment is time-shared by many telephone lines. In electromechanical systems, common control apparatus consists of hardware—an array of hundreds of relays wired together to do the switching jobs of a particular telephone exchange.



Memory card, 6½ by 10½ inches, used for storing the ESS control program. Useful information (64 forty-four-bit words) is carried by the card in the form of magnetized spots ("zero") and unmagnetized spots ("one"). The random-access memory stores the control program and other data on 2048 such cards (131,072 words). The control instructions themselves require a minimum of 100,000 words.

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More specifically, ESS common control consists of an electronic data processor with a large memory. The memory contains instructions for processing all of the different kinds of calls handled by a central office. Guided by this stored program, the data processor receives and interprets dialed digits, sends signals to appropriate switches, and at the same time detects and diagnoses circuit malfunctions.

With this flexible common control, combining hardware and software, ESS can efficiently provide the various telephone services available today as well as any new services needed for the future.



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