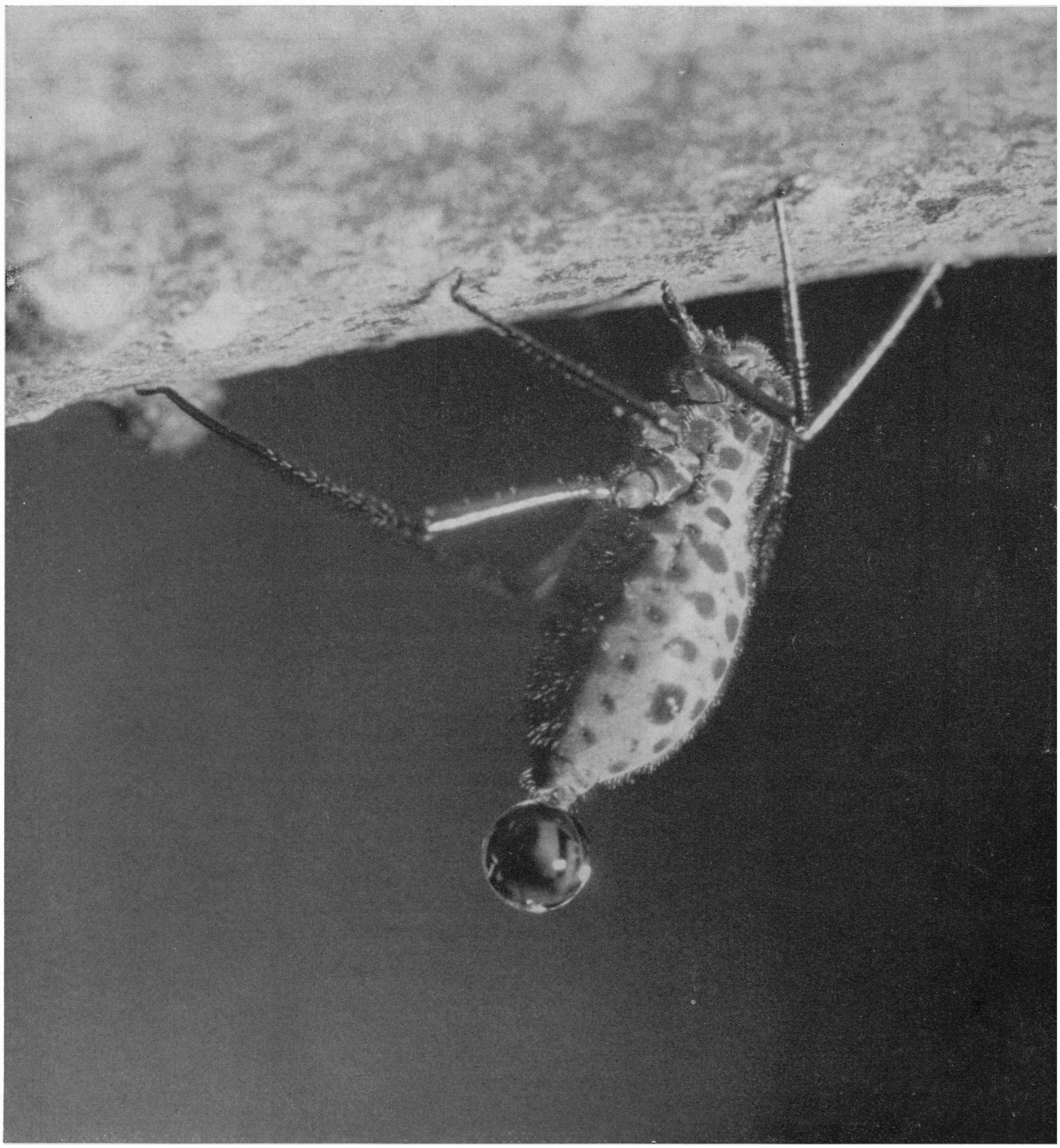
SCIENCE

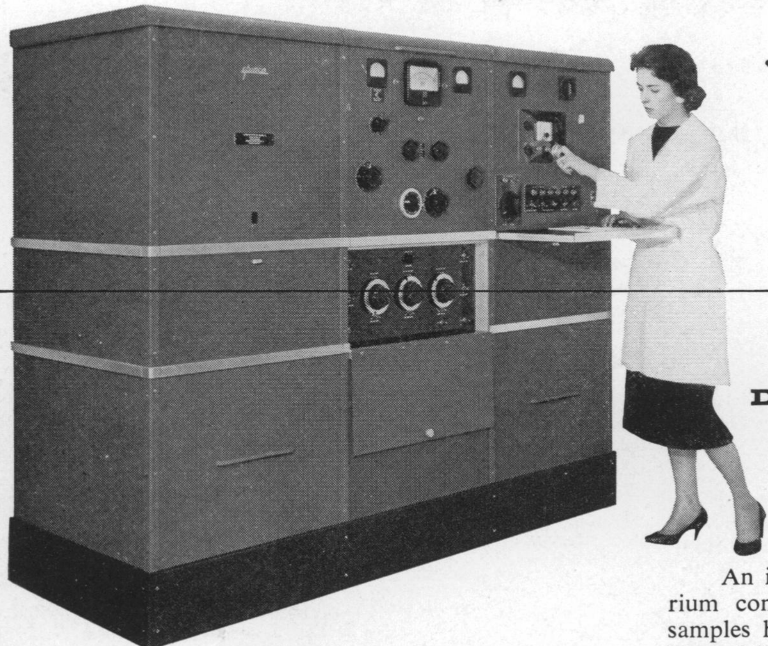
13 January 1961

Vol. 133, No. 3446

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



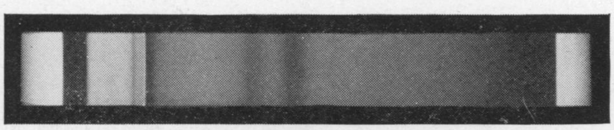
The Analytical Ultracentrifuge



... now more useful than ever for studying molecules

Density Gradients

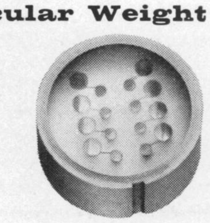
Macromolecules of nearly identical density can be separated and measured by the powerful, rapidly developing technique of density gradient ultracentrifugation. A solution such as cesium chloride is centrifuged with the sample and a concentration gradient created in the cell by centrifugal force. The macromolecules of sample seek the level in the cell corresponding to their own density. The resultant discrete bands can be photographed by absorption optics.



An example of the extreme power of this method is shown here in the separation of DNA's, one containing N_{14}, the other N_{15}.

A summary of density gradient techniques for both analytical and preparative ultracentrifuges has been published by Spinco and copies are available on request.

Rapid Molecular Weight Determinations of Multiple Samples



An ingenious ultracentrifuge cell in which equilibrium conditions can be reached rapidly on multiple samples has been described by David Yphantis of the Rockefeller Institute.

The cell features multiple filling reservoirs and measuring chambers which allow a number of sample-solvent pairs to be studied simultaneously. The use of short column heights makes it possible to establish equilibrium conditions quickly. With an 0.8 mm column, equilibrium is attained in 15 minutes for sucrose (M.W.=342), 45 minutes for ribonuclease (M.W.=13,683), and 70 minutes for bovine serum albumin (M.W.=66,000).

The need for only a small volume of sample is another feature of this unusual cell which promises to find wide appplication for rapid measurements of molecular weight.

Sedimentation of High Polymers

Of special interest to polymer chemists is a comprehensive summary on sedimentation of synthetic and natural polymers by R. L. Baldwin of the University of Wisconsin (now at Stanford) and K. E. Van Holde of the University of Illinois. The authors discuss in detail the kinds of information obtainable by ultracentrifugation, and methods used. An appendix lists polymers run on the Ultracentrifuge, solvents, and literature references.

The work appeared in the first issue of the German journal "Advances in Polymer Science"; reprints (in English) are available from Spinco.

If you are not familiar with the Ultracentrifuge, we will be happy to send you copies of "An Introduction to Ultracentrifuge Techniques" and the latest issue of "Fractions", a periodical sent to owners of Spinco ultracentrifuges, electrophoresis-diffusion instruments and amino acid analyzers. Write Beckman Instruments, Inc., Spinco Div., Stanford Industrial Park, Palo Alto 5, Calif.

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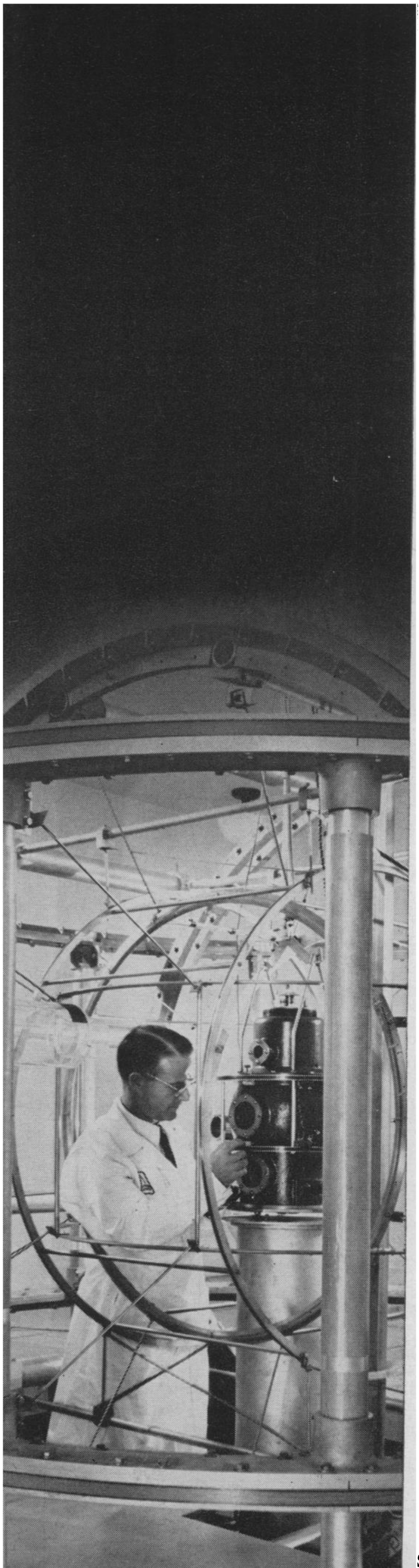
SCIENCE

Cover Fully grown individual of the aphid *Longistigma caryae* (Harris) feeding on the lower side of a linden (*Tilia americana* L.) branch. The stylets are inserted into the conducting phloem. The animal does not suck; it can feed because of the internal pressure of the plant. It releases surplus sugar solution in the form of a honeydew droplet about once every 30 minutes (about × 11.5). See page 73. [Martin H. Zimmermann, Harvard University]

One of a series.



Why we eliminated the earth's magnetic field . . . almost

In an isolated laboratory in southwestern Ohio, GM Research scientists have reduced the earth's magnetic field to one ten-thousandth of its usual strength. This is about as weak as the interplanetary field detected by the Pioneer V solar satellite.

Why neutralize the earth's field? To perform with precision one of the more fundamental experiments in magnetism — measuring the Einstein-DeHaas effect. The measurement is simple in concept, experimentally difficult because of the tiny forces involved. It is made by suspending a ferromagnetic rod in a nearly field-free environment . . . magnetizing the rod . . . then measuring the effect (how much the rod rotates) when this known magnetization is reversed.

The beauty of the experiment is that the resulting values can be related directly to the motions of electrons in the rod. The values indicate the large portion of magnetization due to the *spin* of electrons . . . and the slight, but theoretically important, remaining portion due to *orbital* motion of electrons.

These measured values are helping scientists form a better understanding of the perplexing phenomenon — ferromagnetism. Currently being pursued in cooperation with the Charles F. Kettering Foundation, this long-standing project is one of the ventures in basic research of the General Motors Research Laboratories.

General Motors Research Laboratories
Warren, Michigan

Gyromagnetic Ratios

Iron	*a* 1.92	*b* 1.90
Cobalt	1.85	1.83
Nickel	1.84	1.83
Supermalloy	1.91	1.91

Comparison of (a) gyromagnetic ratios measured in the new Kettering Magnetics Laboratory with (b) corresponding ferromagnetic resonance measurements. These ratios would equal 2 if magnetization were due only to electron spin, or 1 if due only to orbital electron motion.

System of Helmholtz coils used to neutralize earth's magnetic field.

Letters

National Cancer Institute Monographs

The National Cancer Institute publishes monographs presenting series of papers on specific subjects of importance to cancer research and proceedings of conferences and symposia dealing with cancer and closely related research fields.

Four monographs have appeared to date: No. 1, "Estrogen-Induced Tumors of the Kidney in the Syrian Hamster" (December 1959); No. 2, "Symposium on Normal and Abnormal Differentiation and Development" (March 1960); No. 3, "Conference on Experimental Clinical Cancer Chemotherapy" (August 1960); and No. 4, "Symposia—Tumor Viruses" (September 1960).

Investigators, institutions, or sponsors of meetings should write to me for information concerning submission of material. Manuscripts offered for publication as a National Cancer Institute monograph should conform to the instructions to authors appearing on the inside back cover of the *Journal of the National Cancer Institute.*

MICHAEL B. SHIMKIN
National Institutes of Health, Bethesda, Maryland

Progeny Yields in Drosophila

In a recent report by W. C. Levengood and M. P. Shinkle [*Science* **132**, 34 (1960)] regarding environmental factors influencing progeny yields in *Drosophila* it is stated that "atmospheric pressure effects on progeny yields . . . appear not to have been previously reported." Although comparatively little work has been done, there have been some publications applicable to the subject. For example, Stephen and Bird [*Can. Entomologist* **81**, 132 (1949)] studied some effects of different pressure levels on oviposition in the cabbage worm, *Pieris rapae.* Moreover, in reviews by Uvarov [*Trans. Entomol. Soc. London* **79**, 1 (1931)] and Wellington [*Can. J. Research* **24**, 51 (1946)] reference is made to Pictet's studies on pressure effects on emergence of *Pieris* adults. Although Levengood and Shinkle seem to have been concerned principally with numbers of progeny in their experiments, the observations by Pictet and by Stephen and Bird are directly applicable to experiments concerning progeny yields. Stephen and Bird found increased oviposition in insects exposed to relatively low pressures (900 to 930 mbar) as compared with that at higher pressures. Pictet reported that pressure changes might contribute to the success or failure of *Pieris* to emerge from the pupa. Parental oviposition and subsequent emergence from the pupal stage each may influence the final number of adult progeny. Incidentally, the results of Stephen and Bird (increased oviposition at lower pressures) do not support the data of Levengood and Shinkle (decreased number of progeny from matings during lower pressure).

Levengood and Shinkle also report results of rearings of *Drosophila* in an electrical "field." They found a lack of correlation between numbers of progeny and pressure level during mating, under the influence of the field. However, they do not give the amount of variability in the progeny data—a statistic which would aid in interpretation of these data, particularly since so much stress is placed upon this negative effect. The field presumably was developed through and around the culture medium. It would also have been helpful, therefore, if some indication of the dielectric capacity of the culture medium were given, since the dielectric capacity is inversely related to the field strength within the medium.

The authors appear not to have been too sure of the difference between an electrical *field* and an *amount* of electricity. For example, they state that the "electrostatic field strength was estimated to be 7×10^2 coul." But a coulomb expresses quantity of electricity, quite distinct from field strength per se. The latter should be expressed in terms of force (newtons) or electric intensity (newtons per coulomb) [J. A. Chalmers, *Atmospheric Electricity* (Pergamon, New York, 1957)]. As Chalmers stated, many authors refer to the electrical field of the atmosphere in terms of the potential gradient (volts per meter); the difference between the latter unit and electric intensity (E) is merely one of sign.

I am not clear on the meaning of the last two paragraphs of the report of Levengood and Shinkle. For example, in the sentence, "The electric field appears to provide a certain amount of protection and reduces the variations found outside the field"—variations in what? And in the sentence "Flies in the electric field are, in a sense, protected or shielded from external fluctuations," what external force is fluctuating? Are the authors referring in these two sentences to the natural, atmospheric electrical field? If they are, it seems to me that the field (potential gradient) within the laboratory building would not be important any-

(*Continued on page 115*)

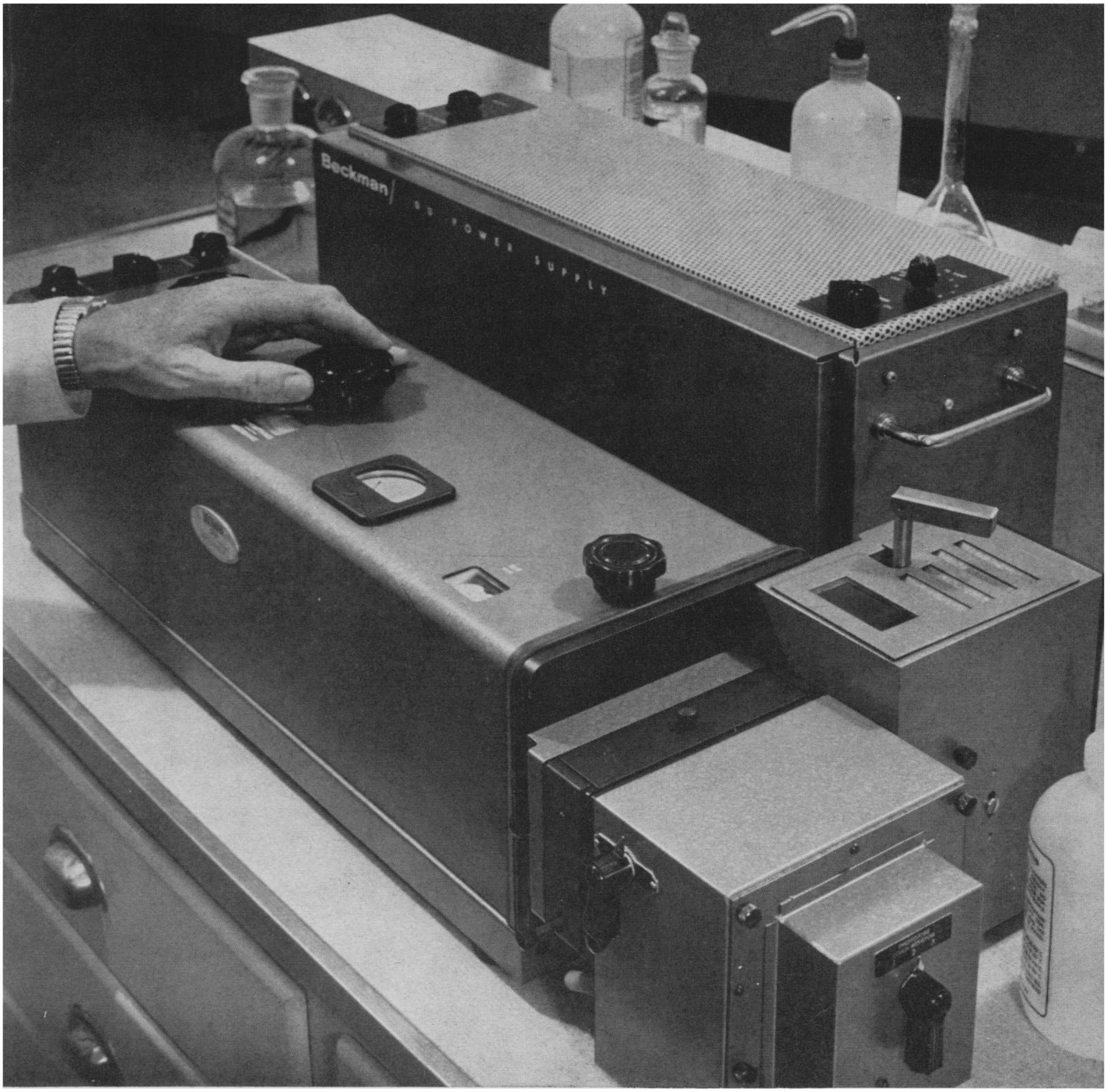


PHOTO BY WILL CONNELL

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A Strategy for Developing Talent

Our present policy for identifying and educating talented persons is, in good part, simply the mechanical product of our testing techniques, and there is good reason to question whether this policy is the best possible. Testing techniques, because of their use of certain statistical measures, tend to favor the broad scholar, the student with many interests and abilities. A more consciously directed program, however, might offer a different emphasis. This analysis and a new strategy based on it are given in Dael Wolfle's article on "Diversity of Talent" in *The American Psychologist,* August, 1960. The strategy is to increase our cultivation of persons who are not well-rounded, who are eccentric, one-sided, yet who, at least on that one side, are really superior. The claim is that such cultivation is valuable both from the viewpoint of the young persons whose future we guide and of the society in which they are to make their way.

There is nothing backhanded, according to the article, in the manner in which the broad, well-rounded student is favored by testing techniques. In selecting students for scholarships and fellowships and for admission to the next higher educational level, the present tendency is to use general measures of ability, to use the sum or the average of separate scores for separate types of ability, for example, rather than the separate scores directly. And there are good scientific reasons for this tendency. The use of sums or averages gives the best correlation between test scores and later achievement. Our measures of achievement in life, for the most part, are composites of several factors, and they are best predicted by tests that are also composites of several factors.

Good scientific grounds, however, may also be offered for not letting a concern with degree of correlation dominate talent development. For one thing, so the analysis continues, although different kinds of ability are often associated with one another, the association is far short of perfect. Some psychologists hold that a small number of primary abilities is sufficient to describe human ability, others find that a great number of special abilities is needed for this purpose, but all are agreed that ability is not a single, undivided trait. Another point about which psychologists are generally agreed is that an assortment of patterns of ability is consistent with achievement in a given profession. There has been a search for characteristic patterns of ability for various professions and it has failed. This means, according to the present analysis, that medicine, law, engineering, various branches of science, and other vocations all will profit by embracing diverse patterns of ability.

The strategy proposed, of course, does not call for slackening in the attention paid to the student who scores high everywhere. This student would get the same support he now gets, but attention would also be paid to the person who is exceptional in only one area. The strategy might mean poorer correlation between tests and subsequent achievement. The bet is, however, that it is a more productive way to increase the talent pool than simply to dip below the generally superior level, continuing to base awards on averages. In fact, the bet is that the strategy will enlarge the talent pool without loss in over-all quality. Students who, because of high gifts and intense interests along one line of endeavor, have neglected other lines would themselves no longer be neglected.—J.T.

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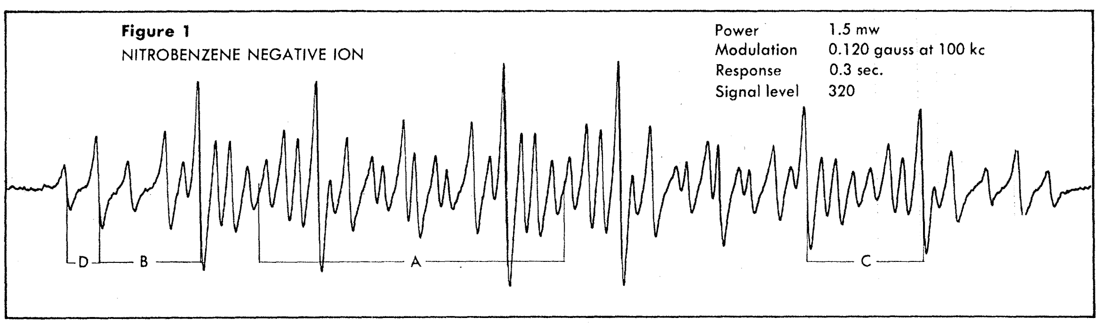
EXAMPLE

Electrolytic production of negative ions.



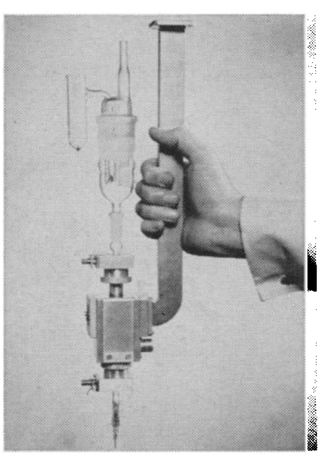


Figure 2 Electrochemical cell as used with the spectrometer

Recently Maki and Geske[1] reported a radically new and important application of EPR. They showed that it was now possible to observe directly the one electron transfer process in the electrolytic reduction of nitrobenzene to the negative ion. They prepared the negative ion by constant potential electrolysis of nitrobenzene in a solution of acetonitrile with tetra-n-propylammonium perchlorate as supporting electrolyte. Such methods of production of negative ions are preferable to the metal reduced systems in that the EPR spectrum can be interpreted completely without complication of interaction by the metal.

Figure 1 shows the spectrum of the nitrobenzene negative ion when generated from a solution of benzonitrile and tetra-n-propylammonium perchlorate[2]. Forming the ion in benzonitrile seems to improve the resolution of the spectrum obtained. The predicted 54 lines are easily observed.

Splitting (A) represents the nitrogen coupling constant which is 10.3 gauss. Splitting (B), (C) and (D) correspond to the coupling constants of the ortho, para and meta hydrogens. The electrochemical cell used in the generation of the negative ions is illustrated in Figure 2 and is a modification of the V-4548 aqueous sample cell accessory.

[1] *JACS 82, 2671 (1960).*
[2] *Sample donated by Dr. R. Adams, University of Kansas.*

For literature which fully explains the 100 kc EPR Spectrometer and its application to basic and applied research in physics, chemistry, biology and medicine, write the Instrument Division.

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The 1960 officers and officers-elect of the American Speech and Hearing Association are as follows: President, Stanley Ainsworth, professor of speech correction and chairman of the program on exceptional children at the University of Georgia; president-elect, Paul Moore, director of the Gould Research Laboratories, William and Harriet Gould Foundation of Chicago, and professor of speech pathology at Northwestern University; executive vice-president, Jack Matthews, chairman of the speech department and director of the speech clinic at the University of Pittsburgh; chairman of the publications board, Wendell Johnson, professor of speech pathology and psychology at the University of Iowa; vice-president, Jack Bangs, director of the Houston Speech and Hearing Center; vice-president-elect, Duane Spriesterbach, professor of speech pathology and audiology at the University of Iowa; and executive secretary, Kenneth O. Johnson, national office of the American Speech and Hearing Association in Washington, D.C. The newly elected AAAS Council representative is Mildred C. Templin, professor, Institute of Child Development and Welfare, University of Minnesota.

KENNETH O. JOHNSON
Washington, D.C.

Forthcoming Events

January

24–27. Society of Plastics Engineers, 17th annual conf., Washington, D.C. (T. A. Bissell, SPE, 65 Prospect St., Stamford, Conn.)

25–27. Mathematical Assoc. of America, annual, Washington, D.C. (H. L. Alder, Dept. of Mathematics, Univ. of California, Davis)

26–27. Western Spectroscopy Conf., 8th annual, Pacific Grove, Calif. (R. C. Hawes, Applied Physics Corp., 2724 S. Peck Rd., Monrovia, Calif.)

27–28. Royal College of Physicians and Surgeons, annual, Ottawa, Ontario, Canada. (T. J. Giles, 150 Metcalfe St., Ottawa)

28–30. Control of the Mind, symp., San Francisco, Calif. (Dept. of Continuing Education in Medicine, Univ. of California Medical Center, San Francisco 22)

28–31. Infertility, sectional meeting, Intern. Fertility Assoc., Acapulco, Mexico. (M. L. Brodny, 4646 Marine Dr., Chicago 40, Ill.)

29–3. American Inst. of Electrical Engineers, winter meeting, New York, N.Y. (E. C. Day, AIEE, Technical Operations Dept., 33 W. 39 St., New York 18)

30–3. Clinical Cong. of Abdominal Surgeons, Miami Beach, Fla. (B. F. Alfano, 663 Main St., Melrose 76, Mass.)

30–4. American Library Assoc., midwinter meeting. (Mrs. F. L. Spain, New York Public Library, 20 W. 53 St., New York, N.Y.)

31–4. American Assoc. of Physic Teachers, New York, N.Y. (F. Verbrugge, 135

Main Engineering, Univ. of Minnesota, Minneapolis)

31–4. American Physical Soc., annual, New York, N.Y. (K. Darrow, APS, Columbia Univ., 116th St. and Broadway, New York)

February

1–3. Solid Propellant Rocket Conf., American Rocket Soc., Salt Lake City, Utah. (R. D. Geckler, Aerojet-General Corp., P.O. Box 1947, Sacramento, Calif.)

1–3. Winter Military Electronics Conv., 2nd, Inst. of Radio Engineers, Los Angeles, Calif. (A. N. Curtiss, IRE Business Office, 1435 S. La Cienega Blvd., Los Angeles 35)

1–4. American Physical Soc., annual, New York, N.Y. (K. K. Darrow, APS, 538 W. 120 St., New York 27)

2–4. Congress on Administration, 4th annual, Chicago, Ill. (R. E. Brown, American College of Hospital Administrators, 840 N. Lake Shore Dr., Chicago 11)

6–8. American Acad. of Allergy, 17th annual, Washington, D.C. (J. O. Kelly, 756 N. Milwaukee St., Milwaukee 2, Wis.)

6–8. Geodesy in the Space Age, symp., Ohio State Univ., Columbus. (W. A. Heiskanen, Ohio State Univ., 1314 Kinnear Road, Columbus 12)

6–10. British Medical Assoc., annual, Auckland, New Zealand (E. Grey-Turner, B.M.A., Tavistock Sq., London, W.C.1)

9–15. Second Allergy Conf., Nassau, Bahamas. (I. M. Wechsler, P.O. Box 1454, Nassau)

13–16. American Soc. of Heating, Refrigerating and Air-Conditioning Engineers, Chicago, Ill. (R. C. Cross, 234 Fifth Ave., New York 1)

14–15. Conference on Microdosimetry, 2nd, Rochester, N.Y. (N. Kreidl, Bausch & Lomb Optical Co., Inc., Rochester 2)

15–17. International Solid-State Circuits Conf., Philadelphia, Pa. (J. J. Suran, Bldg. 3, Room 115, General Electric Co., Electronics Park, Syracuse, N.Y.)

16–18. Biophysical Soc., annual, St. Louis, Mo. (W. Sleator, Dept. of Physiology, Washington Univ., St. Louis 10)

22–25. American Educational Research Assoc., annual, Chicago, Ill. (G. T. Buswell, 1201 16th St., NW, Washington 6)

23–25. American Orthopsychiatric Assoc., annual, New York, N.Y. (Miss M. F. Langer, 1790 Broadway, New York 19)

23–25. Fifteenth Annual Symp. on Fundamental Cancer Research, Houston, Tex. (Publications Dept., Univ. of Texas M.D. Anderson Hospital and Tumor Inst., Texas Medical Center, Houston 25)

23–25. Symposium on Molecular Basis of Neoplasia, Houston, Tex. (Publications Dept., Texas Medical Center, Houston 25)

26–1. American Inst. of Chemical Engineers, natl., New Orleans, La. (F. J. Van Antwerpen, AICHE, 25 W. 45 St., New York 36)

26–2. American Inst. of Mining, Metallurgical, and Petroleum Engineers, annual, St. Louis, Mo. (AIME, 29 W. 39 St., New York 18)

27–3. Conference on Analytical Chemistry and Applied Spectroscopy, 12th, Pittsburgh, Pa. (L. P. Melnich, U.S. Steel Corp., Monroeville, Pa.)

(See 16 December issue for comprehensive list)

New Products

The information reported here is obtained from manufacturers and from other sources considered to be reliable. Neither Science *nor the writer assumes responsibility for the accuracy of the information. All inquiries concerning items listed should be addressed to the manufacturer. Include the department number in your inquiry.*

■ THERMOMETER ENTRY PORT for use with 10/30 standard-taper laboratory glassware is manufactured of Teflon and consists of a high-vacuum O-ring seal permitting use of pressure to 8 mm-Hg and temperatures as high as 500°F. The seal permits adjustment of stem exposure. (Arthur F. Smith, Inc., Dept. Sci7A, 311 Alexander St., Rochester 4, N.Y.)

■ X-RAY VACUUM SPECTROMETER, designed for use with the manufacturer's x-ray diffractometers, permits elements of atomic number 12 and higher to be analyzed spectrochemically. The sample chamber, which simultaneously accommodates three samples up to 5 cm in diameter and 2 cm thick, is isolated from the remainder of the vacuum system. Crystals of lithium fluoride and gypsum are used to analyze the radiation; a scintillation counter and a proportional flow counter are used as detectors. Operating vacuum is achieved in about 5 min; 30 to 60 sec is required to re-establish equilibrium after samples are changed. (Radio Corporation of America, Dept. Sci4, Building 15-1, Camden 2, N.J.)

■ METAL WORKING MACHINE of multifunctional design converts from a 10-in bench lathe to a vertical milling machine, drill press, or jig borer. A vertical column attached to the back of the lathe bed accepts the detachable headstock for conversion. The column does not interfere with lathe operations. (American Edelstaal, Inc., Dept. Sci-13A, 350 Broadway, New York, N.Y.)

■ BINARY DIGITAL RECORDER handles digital information at rates up to 150 lines of 32 bits each per second. A recorded bit is made for a −10-volt input; zero voltage inhibits recording to represent the digital zero. Electrosensitive paper is used at speeds from 2.5 to 25 in./sec. Standard designs incorporate up to a maximum of 32 recording channnels and an ungated timemark channel. Higher paper speeds and a larger number of channels are available on special order. (Electronic Counters, Inc., Dept. Sci1, 155 Eileen Way, Syosset, N.Y.)

■ MAGNETOHYDRODYNAMIC FLOW FACILITY furnishes a continuous flow of ionized gas with velocity to 4500 m/sec at 10,000°K and an average conductivity of 1 mho/cm. The gas is produced by a gas-stabilized electric arc. The hot gas proceeds through a mixing chamber into a supersonic nozzle and is expelled in an expanded condition as a low-pressure supersonic flow. The flowing gas is available for experimentation in a constant-diameter channel contained within a water-cooled transparent tube. (MHD Research, Inc., Dept. Sci2, 1571 Placentia, Newport Beach, Calif.)

■ MICROWAVE RELAY LINK, for point-to-point communication and data channels, operates in the 10,500 to 13,200 Mcy/sec range, has a band width of 5 Mcy/sec flat within 0.5 db, and power output 0.1 watt. The transmitter and receiver are each self-contained in individual units weighing 31 and 32 lbs respectively. The system is portable and may be mounted on a tripod or other base. Features include: plug-in intermediate-frequency amplifiers, variable-frequency wavemeter, built-in signal attenuator, and a built-in test meter for tuning and voltage measurements. (Electronic Systems, Dept. Sci10, 1479 River St., Jackson, Mich.)

■ RADIOISOTOPE HANDBOOK and decay-rate calculator furnishes 64 pages of general and technical information useful to the user or potential user of radionuclides. Chapters on fundamentals and definitions, radiation, nuclear fission and nuclear reactors, radioisotope production, radiation shielding, uses of radioisotopes, and cobalt-60 are included. Data are also furnished in four

appendixes. The decay-rate calculator is a circular-disk type that provides information on remaining activity when half-life and original activity are inserted. The handbook and the calculator are both available free of charge in small quantities. (Atomic Energy of Canada Ltd., Dept. Sci12, Commercial Products Div., P.O. Box 93, Ottawa, Can.)

■ DYNAMIC BALANCER for gyros consists of a balancing stand and an amplifier. Rotors up to 2½ in. in diameter and weighing up to 16 oz are accommodated. Balancing speeds from 8000 to 10,000 rev/min are available. Unbalance vibration as small as 0.25×10^{-6} in. is said to be determined. The tester discriminates between bearing noise and unbalance vibration. Provision is made for analysis of the former. (Micro Balancing, Inc., Dept. Sci3, Herricks Rd., Garden City Park, N.Y.)

■ PULSE GENERATOR furnishes pulses of 0.5 nsec duration at repetition rates of 50 to 60 per second. Spectral intensity is said to be flat within ±0.5 db from 60 kcy/sec to 1000 Mcy/sec. Output into a 50-ohm resistive load is a maximum of 101 db above 1 μv/Mhs and is adjustable in ¼-db steps from 10 db to maximum. Power requirement is 30 watts at 105 to 125 volts, 50 to 60 cy/sec. (Stoddart Aircraft Radio Co., Dept. Sci11, 6644 Santa Monica Blvd., Hollywood 3, Calif.)

■ FREQUENCY CONVERTER delivers 100 va with a wide selection of frequency ranges from 50 to 4000 cy/sec and fixed-frequency accuracy said to be ±0.001 percent. Nominal harmonic distortion is 1 percent. The unit has zero output impedance and zero recovery time and is capable of handling resistive or reactive loads. (Tel-Instrument Electronics Corp., Dept. Sci5, 728 Garden St., Carlstadt, N.J.)

■ FREQUENCY MEASUREMENT to 220 Mcy/sec is provided by model 1290 extender for use with the manufacturer's model 1039 solid-state counter timer. The combination can be utilized for measurement of frequency, period, time, ratio, and phase. (Systron-Donner Corp., Dept. Sci6, 950 Galindo St., Concord, Calif.)

■ CURRENT MEASURING INSTRUMENT has full-scale ranges variable from 1 ma to 3 na in 12 settings. Drift is said to be less than 0.01 percent/hr, and accuracy ±1 percent of full scale. Response time is 10 msec. An auxiliary output provides for driving a 1-ma recorder. (Elcor Inc., Dept. Sci8, Falls Church, Va.)

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Letters

(Continued from page 68)

way, due to the Faraday effect of the building. If the authors found that there was a field within the building, there would still be a Faraday effect applicable to the culture medium within the bottles.

In experiments to study progeny yields one should also consider the factors which affect behavior and oviposition of the parents, in addition to those factors which might act on larval development. In this regard, one of the "unknown factors" Levengood and Shinkle associated with barometric pressure changes might be air ions. Air-ion densities are known to change with different kinds of weather, and I have found that positive air ions can influence the activity of adult blowflies.

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We would first like to comment on Edward's question concerning variability in progeny yields from cultures subjected to the influence of the electric field. The 16 cultures in the electric field disclosed a mean deviation of 32.3 percent, whereas the control-group data showed a mean deviation of 52.4 percent. Also, the average progeny yield of flies grown in the electric field was 35.4 percent higher than the average for the control groups. When we made the statement that the electric field appears to provide a certain amount of protection we were, of course, referring to this decrease in variation and increase in progeny yield from cultures within the electric field. These figures were not included initially, due to the inevitable discrepancy between the allotted space and the amount of information one wants to provide.

We feel that the outer envelope of glass (the culture bottle) is the most important factor in reducing the field strength. The dielectric constant of glass varies between 5 and 10, and in our calculations we used a value of 8 to be on the high side. The magnitude of the electrostatic field approximated from the physical dimensions is 7×10^{-9} coul; the exponent was inadvertently changed from −9 to 2 when the manuscript was initially compiled. If Edwards prefers that the field be expressed in terms of electrostatic field intensity, then it is again necessary to make approximations because of shape factors. The general field intensity in which the bottles were placed was about 2.5×10^5 v/m. The directional field may be of sufficient strength to produce ionic drift toward the electrodes and decrease the density of air ions within the bottles. The effects of ions with known specific charges on physiological processes have been previously reported by Krueger *et al.* [*Proc. Soc. Exptl. Biol. Med.* **102**, 355 (1959)].

Ionizing radiation produced by cosmic rays is known to affect the electric and geomagnetic fields surrounding the earth. These fluctuating electric-field effects at high altitudes are believed to influence the production of less energetic ions at the earth's surface. The ionization at lower altitudes is also affected by barometric pressure, and the increase in ionization with decreasing pressure is an absorption effect. It is conceivable that this increase in ionization with decreasing barometric pressure could account for the pronounced decrease in the progeny yields from control cultures. It is these air-ion effects which we feel are significant in causing the variations, and not a Faraday effect as suggested by Edwards.

In reviewing the literature, no reference could be found pertaining to the effects on *Drosophila melanogaster* of varying barometric pressure. Pictet (1904–21) makes no reference to *D. melanogaster* but mentions only emergence of adult insects from pupal tissues. He mentions that the majority of adults emerge on the fall of the barometer; this could be explained possibly by brittle pupal cases, the result of greater evaporation of liquids at the lower pressure. This has nothing to do with matings in *Drosophila.* Also, Parman has stated that adult insects seem to emerge during periods of high pressure [D. C. Parman, *J. Econ. Entomol.* **13**, 339 (1920)]; thus, the effect of pressure on emergence appears to be in question.

As Edwards stated, Stephen and Bird observed an increase in oviposition in *Pieris rapae* at low pressures; however, an aspirator was used to produce the variations in pressure. This creation of artificial pressure variations would not correlate with changes such as air-ion variations occurring with natural fluctuations in atmospheric pressure. Also, these experimenters consider only one stage in the life cycle of the insect, whereas our experiments are based on complete life cycles of a number of generations of *D. melanogaster.*

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