<table>
<thead>
<tr>
<th>No.</th>
<th>Date of Issue</th>
<th>Pages</th>
<th>No.</th>
<th>Date of Issue</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>3562</td>
<td>5 April</td>
<td>1–92</td>
<td>3569</td>
<td>24 May</td>
<td>843–926</td>
</tr>
<tr>
<td>3563</td>
<td>12 April</td>
<td>93–252</td>
<td>3570</td>
<td>31 May</td>
<td>927–1010</td>
</tr>
<tr>
<td>3564</td>
<td>19 April</td>
<td>253–336</td>
<td>3571</td>
<td>7 June</td>
<td>1011–1162</td>
</tr>
<tr>
<td>3565</td>
<td>26 April</td>
<td>337–436</td>
<td>3572</td>
<td>14 June</td>
<td>1163–1254</td>
</tr>
<tr>
<td>3566</td>
<td>3 May</td>
<td>437–512</td>
<td>3573</td>
<td>21 June</td>
<td>1255–1354</td>
</tr>
<tr>
<td>3567</td>
<td>10 May</td>
<td>513–750</td>
<td>3574</td>
<td>28 June</td>
<td>1355–1438</td>
</tr>
<tr>
<td>3568</td>
<td>17 May</td>
<td>751–842</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Names of authors of books reviewed are printed in SMALL CAPITALS.

AAAS: Cleveland meeting—preliminary announcement, 907; Financial report, 1241
AAAS (Affiliates): American Society of Clinical Hypnosis, 321; Conference Board of the Mathematical Sciences, 416; Society of Technical Writers and Publishers, 830
Abandonment of rational attitudes (letter), I. de Sola Pool, 1174
Abelson, P. H.: editorials: Creativity in the sciences, 1271; Devil's advocates, 1365; Effective use of scientific advice, 939; International competition in science, 773; Manned lunar landing, 267; Serendipity in research, 1177; Some needed reforms, 577
Accuracy of radiocarbon dates, W. F. Libby, 278
Acetylcholine and cholinacetylase content of synaptic vesicles, E. De Robertis et al., 300
Ackerman, E.: Biophysical science, book review of, 168
Acoustic activity recorder for burrowing animals, C. Gans and J. J. Bonin, 398
Adams, E. N.: Devaluation of the dollar (letter), 1141
Adams, J. N., and S. G. Bradley: Recombination events in the bacterial genus Nocardia, 1392
Adaptation to displaced vision: visual, motor, or proprioceptive change? C. S. Harris, 812
Adipose tissue: ability to respond to nerve stimulation in vitro, J. W. Correll, 387
Adkinson, B. W.: Primary scientific publication and the federal government, 613
Advances in ecological research, vol. 1, J. B. Craig (Ed.), book review by T. Burnett, 636
Advances in immunology, W. H. Taliaferro and J. H. Humphrey (Eds.) book review by R. A. Good, 1388
Advances in nuclear science and technology, vol. 1, E. J. Henley and H. Kouts (Eds.), book review by C. O. Muelhause, 656
Aeolian zone, L. W. Swan, 77
Agency for International Development. See News and comment
Aging in America. See News and comment
Akamine, E. K.: Ethylene production in fading Vanda orchid blossoms, 1217
Alaupovic, P. See Skinner, W. A.
Albert, L. S. See Wallenstein, A.
Albumin replacement by fatty acids in clonal growth of mammalian cells, R. G. Ham, 802
Alcohol and caffeine: effect in inferred visual dreaming, S. C. Gresham et al., 1226
INDEX TO VOLUME 140

Cadmium: uptake by vegetables from superphosphate in soil, H. A. Schroeder and A. E. C. Johnson, 1108
Callaham, L. L., Russian-English chemical and polynucleotide dictionary, book review of, 654
Caloric values of microcrustracea, G. W. Braden and J. B. Phillips, 665
Campbell, D. T., see Segall, M. H.
Campbell, F. L., book review of The infections, 1078
Can: from the direction of flow of time be determined?, R. G. Sachs, 1284
Cancer: relation of prenatal radiation to development of the disease in child-

Boyer, D. R.: Hypoxia: effects on heart rate and respiration in the snapping turtle, 813
Bradley, S. G. See Adams, J. N.
Bradley, J. C., et al.: see Bloom, W.
Brandriss, M. W.: Methotrexate: suppression of experimental allergic encephalo-
phoritis in mice, 186
Brant, A. A.: book review of Principles of applied geophysics, 376
Branaung, G. C., et al.: Mycoplasma pneumoniae: proposed nomenclature for atypical pneumonia organism (Eaton agent), 662
Characteristics of the process of aging in algal cells (abstr.), C. Sorokin, 385
Chard, C. S.: book review of Ethnic origins of the peoples of northeastern Asia, 1389
Charger exchange interaction between primary ions and ionized molecules in radiation chemistry (abstr.), L. Kevan and W. F. Libby, 382
Chayes, F.: International Society for Stereology (meeting report), 1247
Chemical analysis: the working tools, C. R. N. STROUTS et al. (Eds.), book review by H. F. Walton, 645
Chemical bonding in the geometry of molecules, G. E. RYSCHKEWITSCH, book review by R. H. Eastman, 645
Chemical examination of a core from Lake Washington, E. H. Hutchinson and U. M. Cowgill, 677
Chemical insect attractants, M. Jacobson and M. Beroza, 1367
Chandler, M. T.: see Chamberlain, T. J.
Chang, S.-S. See Marsh, J. T., et al.
Chesapeake (meeting report): effect on running behavior of rats, E. B. Karsh, 1084
Channel 37 (letter), G. C. McVittie, 1174
Chanock, R. M., et al.: Mycoplasma pneumoniae: proposed nomenclature for atypical pneumonia organism (Eaton agent), 662
Characteristics of the process of aging in algal cells (abstr.), C. Sorokin, 385
Chard, C. S.: book review of Ethnic origins of the peoples of northeastern Asia, 1389
Charger exchange interaction between primary ions and ionized molecules in radiation chemistry (abstr.), L. Kevan and W. F. Libby, 382
Chayes, F.: International Society for Stereology (meeting report), 1247
Chemical analysis: the working tools, C. R. N. STROUTS et al. (Eds.), book review by H. F. Walton, 645
Chemical bonding in the geometry of molecules, G. E. RYSCHKEWITSCH, book review by R. H. Eastman, 645
Chemical examination of a core from Lake Washington, E. H. Hutchinson and U. M. Cowgill, 677
Chemical insect attractants, M. Jacobson and M. Beroza, 1367
Cantlon, J. E. See Curtis, E. J. C.
Carbamyl phosphate, M. E. Jones, 1373
Carbon: a new crystalline phase, R. B. Aust and H. G. Dickramer, 817
Carbon isotope abundance in meteoritic carbon, R. G. Boyer, 192
Carbon-isotope composition and the origin of calcareous coal balls [Science 138, 900 (1962)], erratum, 1080
Carbon tetrachloride poisoning in rats: alteration in the ribonucleic acid of the liver, E. A. Smucker and E. P. Benditt, 308
Cardiovascular responses of the chicken to seasonal and induced temperature changes, J. A. Vogel and P. D. Sturkie, 1404
Cardon, P. V., Jr. See Birren, J. E., et al.
Carli, G., et al.: Electroencephalographic desynchronization during deep sleep after destruction of midbrain-limbic pathways in the cat, 677
Carrington, R. See Wisotsky, J., et al.
Carrison, L. C. See Scarl, C. B.
Carson, H. L., Heredity and human life, book review of, 120
Carter, V.: relation to plant disease, book review of, 43
Carter, E. S.: see Boyer, D. R.
Catala, E.: reviewed in a Caucasian family in the United States, E. W. Bailey, 816
Cavaggioni, A.: book review of Physico-
chemical aspects of biology, 374
Cell and tissue penetration chamber: adaptation for microscopy of clonal growth, J. J. Freed, 1334
Cells: their structure and function, E. H. Mercer, book review by J. R. Thorn- borough, 623
Cervallea dieceparus, C. CHANCEUX, book review by G. G. Simpson, 623
Chandler, M. T.: see Chamberlain, T. J.
Chang, S.-S. See Marsh, J. T., et al.
Chesapeake (meeting report): effect on running behavior of rats, E. B. Karsh, 1084
Channel 37 (letter), G. C. McVittie, 1174
Chanock, R. M., et al.: Mycoplasma pneumoniae: proposed nomenclature for atypical pneumonia organism (Eaton agent), 662
Characteristics of the process of aging in algal cells (abstr.), C. Sorokin, 385
Chard, C. S.: book review of Ethnic origins of the peoples of northeastern Asia, 1389
Charger exchange interaction between primary ions and ionized molecules in radiation chemistry (abstr.), L. Kevan and W. F. Libby, 382
Chayes, F.: International Society for Stereology (meeting report), 1247
Chemical analysis: the working tools, C. R. N. STROUTS et al. (Eds.), book review by H. F. Walton, 645
Chemical bonding in the geometry of molecules, G. E. RYSCHKEWITSCH, book review by R. H. Eastman, 645
Chemical examination of a core from Lake Washington, E. H. Hutchinson and U. M. Cowgill, 677
Chemical insect attractants, M. Jacobson and M. Beroza, 1367
INDEX TO VOLUME 140

Electrocardiographic studies of free-swimming sharks, P. W. Gilbert and S. D. Douglas, 1396

Electroconvulsive threshold elevation: from daily stimulation of adrenalectomized rats, C. F. Eising et al., 828

Electroecephalographic desynchronization during deep sleep after destruction of midbrain-limbic pathways in the cat, G. Sulzer, 258

Electroecephalographic responses to ionizing radiation, J. Garcia et al., 289

Electron microscopy of chromosomal transitions in anthers, J. D. Ehrich, et al., 1336

Electronic structure and alloy chemistry of the transition elements, P. A. Beck (Ed.), book review by P. Duwez, 653

Elsevier’s dictionary of general physics in six languages: English/American, French, Spanish, Italian, Dutch, and German, W. E. Clason (Ed.), book review by T. W. Marton, 288

Elton, R. M. See Weber, F. N., Jr., et al., 657


Engel, A. E. J.: Geologic evolution of North America, 143; See Engel, C. G., and A. E. J. Engel: Basalts dredged from the northeastern Pacific Ocean, 853

Engineer looks at physiology, An, R. W., Jones, 461

Enzymatic formation of adenine and other catechols from monophenols, J. Axelrod, 495

Epic of steel, The, D. Fischer, book review by O. C. Shepard, 659

Equilibrium sedimentation of uniform rods of tobacco mosaic virus, F. N. Weber, Jr., et al., 1090


Erosion and deposition of Italian stream valleys during historic time, S. Judson, 852

Errata: “Carbon-isotope composition and the origin of calcareous coal balls” [Science 138, 900 (1962)], 1080; Scientists in the news, re: P. L. Harris, 1297

Errorless discrimination learning in the pigeon: effects of chlorpromazine and imipramine, H. S. Terrace, 318


Etat, R. W.: book review of Archaeology of the Pacific, 1204

Ethnic origin of 125 peoples of northeastern Asia, M. O. Levin, H. N. Michael (Ed.), book review by C. S. Chard, 1389

Ethnic production in fading Vanda orchid blossoms, E. K. Akamine, 1217

Evaporation enhancement by protein films, L. K. James, Jr. and D. J. O. Berry, 312

Everett, S. See News and comment

Evolution in plants and animals, W. BAADe, C. Payne-Gaposchkin (Ed.), book review by J. B. Irwin, 658


Exploring the atmosphere, G. M. B. DORSO, book review by R. G. Fleagle, 653

Eyde, R. H. See Stern, W. L.

Fager, E. W., and J. A. McGowan: Zooplankton species groups in the North Pacific, 433; erratum, 909

Fairman, D. C.: See Boyden, W. H., et al., 570

Falloof, J. C.: See Roll, H. S., et al., 1341

Fanz, R. L.: Pattern vision in newborn kittens, 258

Farr, P., The insects, book review of, 626

Farber, B., Nobel prize winners in chemistry, book review of, 623

Falkner, S. See Burdett, W. J., et al., 570

Fatty acids: in synthesis by the green peach aphid, Myzus persicae (Sulzer), F. E. Strong, 983

Feast, C. V. See Turcotte, E. L.

Feder, B. H. See Stern, J., et al., 657

Federal Communications Commission. See News and comment

Fernandez-Moran, H.: Subunit organization of mitochondrial membranes (abstr.), 381

Field theory of weak interactions (abstr.), A. Pais, 383

Fields for edge-punched filing cards, A. G. Newcombe, 1312

Fieser, L. F., and M. Fieser, Topics in organic chemistry, book review of, 1299

Firsoff, V. A., Moon atlas, book review of, 347

Fischelis, R. P.: More paper work, less research (letter), 721


Fish, R. J. See Roberts, 1153


Fishes, The, F. D. Ommeney, book review by G. W. Read, 626

Fitch, F. W., and E. Anders: Organized element: possible identification in Orgueil meteorite, 1097

Fitts, D. B.: Nonequilibrium thermodynamic, book review of, 168


Flaugher, R. L. See Nunnally, J. C.

Fleagle, R. G.: book review of Exploring the atmosphere, 653

Fleischer, R., and P. B. Price: Tracks of charged particles in high polymers, 1221

Flicker fusion frequency of electrotetrogram in light-adapted goldfish at various temperatures, I. Hanyu and M. A. Ali, 662

Floral induction and the stimulation of cell division in Xanthium, R. G. Thom- as, 55

Flocklin, M., and E. H. Stotz (Eds.), Comprehensive biochemistry, vols. 1–4, book review of, 1201

Fluhri, T., and R. F. Leggett (Eds.), Reviews in engineering geology, vol. 1, book review of, 287

Flygare, W. H.: Bent chemical bonds, 1179

Foggo, G. B.: The growth of plants, book review of, 1082

Foley, P. J. See Lavery, J. J.

Following-response initiation in ducklings: age and sensory stimulation, G. Gottlieb, 399

Fontijn, E. G. See Carignan, G. R.

Foote, R. H.: book review of The mosquitoes of the South Pacific (Diptera, Stomorinae) (letter), 638

Foreign literature of chemistry, J. L. Wood et al., 610

Foreign relations. See News and comment

Fountain, E. J. Lynch, book review by J. E. Lindsay, 655

Fossil forest of Ocd, Panama, W. L. Stern and R. H. Eyde, 1214
INDEX TO VOLUME 140

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>vii</td>
<td>vii</td>
</tr>
</tbody>
</table>

Government research grants (letters), B. Commoner; L. H. Garland, 1048

Cram, C. H., et al.: Visual discriminations of subject with acquired unilateral trianopia (abstract), 381

Grant, V., The origin of adaptations, book review of, 1386

Grants and contracts. See News and comment

Graphs and their uses, o. ore, book review by, L. R. Wilcox, 1298


Graham, M., book review of Knowledge and wonder, 626

Gravitation: an introduction to current research, L. Witten (ed.), book review by, P. Brancazio, 806

Gray, H. B.: book review of The chemistry of the lanthanides, 1388


Gray, Jr., S.: A physiologist looks at engineering, 464

Green, D. E., et al.: Isolation and characterization of the unit of electron transfer in heart mitochondria (abstract), 382


Greenfield and man, The, J. S. Parsons, book review by, J. R. Hendrickson, 885

Greenberg, D. S.: See News and Comment

Greenne, E., S., Principles of physics, book review of, 656

Greenstein, F. L.: Radio stars with large red shift (abstract), 382

Gresham, S. C., et al.: Alcohol and caffeine: effect on inferred visual dreaming, 464


Gross, P. M. See Burdette, W. J., et al.

Gross, A. V.: High-temperature research, 781

Groundwater: flow toward an effluent stream, J. H. Lehr, 1318

Growth, including reproduction and morphological development, P. L. Altman and D. S. Ditterm (Eds.), book review by, E. Zwilling, 638

Growth-regulating chemicals persist in plants: qualitative bioassay, T. J. Muzik and J. W. Whitworth, 1212


Guedditi, G. See Craig, L. C.


Gomatos, P. J., and I. Tamm: Base composition of the RNA of a reovirus variant, 997

Good, R. D.: book review of Advances in immunology, 1388

Gordon, J.: book review of Basic concepts of nuclear chemistry, 648

Gordon, P., and R. Zak: Potentiation by adrenaline of a proteolytic activity associated with myocardial myosin, 294

Gottlieb, G.: Following-response initiation in ducklings: age and sensory stimulation, 399

Government-industry competition. See News and comment


Hahn, F. E., and J. Ciak: Effects of penicillin (letter), 1151

Hallsham, Lord, Science and politics, book review of, 1248
INDEX TO VOLUME 140

K

Jones, J. L.: Ozone damage: protection effect on organic materials, 657
Jones, M. E.: Carbamyl phosphate, 1373
Jones, M. H. See Carterette, E. C.
Jones, R. L., et al.: Microfossils in Wisconsin limestone till from western Illinois and eastern Iowa, 1222
Jones, R. W.: An engineer looks at physiology, 461
Jones, G. C. Captain Cook's last voyage, A. J. LEDYARD, book review by J. Ewan, 1204
Joyal, A. C. See Bromage, P. R., et al.
Juchter, S. Erosion and deposition of Italian stream valleys during historic time, 898
Jura, G. See Souers, P. C.

K

Kaelis, E.: Society for holistic biology (letter), 1362
KAGAN, J., and H. A. MOSS, Birth to maturity, book review of, 287
Kamen, M. D.: Early history of carbon-14, 184
Kaplan, H. S. See Burdette, W. J., et al.
Kash, E. B.: Changes in intensity of punishment: effect on running behavior of rats, 105
KEEN, A. M., Marine molluscan genera of western North America, book review of, 635
Keller, B. See Freedman, D. G.
KELLY, L., Alexander von Humboldt, book reviews of, 747
Kerr, G. T.: Zoolite ZK-5: a new molecular sieve, 1412
Kevan, L., and W. F. Libby: Charge exchange attraction between primary ions and un-ionized molecules in radiation chemistry (abstr.), 382
Khairallah, P. A., et al.: Angiotensinase with a high degree of specificity in plasma and red cells, 672
Kiel, J. I., and Burdette, W. J., et al.
Kier, P. M.: book review of Echinoderms, 42
Kim, H. G. See Weber, F. N., Jr., et al.
KING, L. S.: The growth of medical thought, book review of, 287
Kintsch, W.: All-or-none learning and the role of repetition in paired-associate learning, 310
Kirke, P. L.: Chemicalimastics, 367
Kleinman, G. S.: Creativity and the independent student (letter), 211
Klopgsteg, P. E.: Potpourri and galliumnury, 594
Knoppel, L.: Horizontal convection in the earth's mantle: a mechanism for strike-slip faulting (abstr.), 383
Knowledge and wonder, V. F. WEISSKOPF, book review by M. Graubard, 626
Koehling, F. E., Beroza, J., et al.
Koen, A. L. See Shaw, C. S.
Kolthoff, I. M.: book review of Handbook of analytical chemistry, 1390
Koordberg, P., Ichthyology, Reviews: Evolution of, 974
Koomen, M. J., et al.: Night airglow observation from orbiting spacecraft compared with measurements from rockets, 1087

L

Labbe, R. F. See Onisawa, J.
Lacey, J. L. See Meyers, W. J., et al.
Lactate dehydrogenase isozymes: dissociation and recombination of subunits, C. L. Markert, 1329
Lactic dehydrogenases: subfractionation of isozymes, P. J. Fritz and K. B. Jacobson, 64
LAGLER, K. F., et al., Ichthyology, book review of, 477
LAND, F.: The language of mathematics, book review of, 1298
Landridge, R.: Ribosomes: a common structural feature, 1000
LANDSGREN, H. H., et al., Resources in America's future, book review of, 971
Lange, W.: Oceanographic data, reporting of (letter), 734
Langer, E. See News and comment
Langille, A. R. See Flanagan, T. R.
Language of mathematics, The, F. LAND, book review by L. R. Wilcox, 1298
Larson, D. A. See Skvarla, J. J.
Lasers, B. A. Lengyel, book review by P. A. Franken, 647
Lauritzen, C. W.: Trap water as well as tap solar energy, 1149
Lavery, J. J., and P. J. Foley: Altruism or arousal in the rat?, 172
LaVia, M. F., et al.: Antibody formation in embryos, 1219
LEBEDEV, K. B., The chemistry of rhenium, book review of, 375
LEDDYARD, J., a journal of Captain Cook's last voyage, book review of, 1204
Lee, D. H. K.: Arid lands: environmental physiology and psychology (meeting report), 1002
Lee, L. E., Jr. See Burdette, W. J., et al.
Leopold, H.: Groundwater: flow toward an effluent stream, 1318
Leeming cycle at Baker Lake, Canada, during 1959–62, C. J. Krebs, 674
Lemley, B. A., Lasers, book review of, 647
Leo, M. W. M., and A. Walton: Rhodium-120 fallout: variations in deposition and concentrations in precipitation, 1398
Leonard, S. L. See Schane, H. P.
Lerner, M.: Mariluana: tetrahydrocan- nabinol and related compounds, 175
Levin, M. G., Ethnic origins of the peoples of northeastern Asia, book review of, 1389
INDEX TO VOLUME 140

Levison, A. B.: book review of Conjectures and refutations, 643
Lewis, J. P.: Quiet crisis in India, book review of, 655
Libby, W. F.: Accuracy of radiocarbon dates, 278; See Kevan, L.
Lick, W. J., and H. W. Emmons, Thermodynamic properties of helium, book review of, 797
Likert, R.: Independent research institutes (letter), 424
Lim, P. G., and R. I. Mateles: Trypanoph- and indole-excreting bacterial mutants, 388
Lindsay, J. E.: book review of Formation evaluation, 655
Lipetz, E.: Bionics (meeting report), 1419
Lippman, F.: More paper work, less research (letter), 721
Little, R. N.: book reviews: Introductory atomic physics, 886; Principles of physics, 656
Little science, big science, D. Price, book review by S. Goldberg, 639
Local anesthetic drugs: penetration from the spinal extradural space into the neuraxis, P. R. Bromage et al., 392
Lomonte, J.: Chromosome in Thioecillus thiooxidans, 409
Lorente de No, R., and V. Honrubia: Continuous conduction of action potentials by peripheral myelinated nerve fibers (abstr.), 383
Lower Cretaceous plant microfossils from Minnesota, R. L. Pierce, book review by L. R. Wilson, 1300
Lying stones of Dr. Johann Bartholomew Adam Beringer, the, M. E. Johann and D. J. Wollfe (Eds.), book review by L. P. Williams, 1083

M

Machlup, F.: The production and distribution of knowledge in the United States, book review of, 473
Maclean, B.: Basic research fund policies (letter), 208
Malate dehydrogenases in the rusted bean leaf, R. C. Staples and M. A. Stahmann, 1326
Mammalian X-chromosome action: inactivation limited in spread and in region of origin, L. B. Russell, 976
Manned lunar landing (editorial), P. H. H. Hess, 1173
Manned lunar landing defended (letter), H. H. Hess, 1173
Manpower and mindpower (letter), J. R. McKeiver, 1154
Manpower problems in the training of mathematicians (meeting report), L. W. Cohen, 1116
Manual of vascular plants of northeastern United States and adjacent Canada, H. A. Gleason and A. Cronquist, book review of, 637
Manuel, F. E., Isaac Newton, historian, book review of, 642
Maramorosch, K. See Streissle, G.
Marcus, S.: Weinberg report (letter), 858
Margolis, A. J. See Doyle, L. R.
Marston, T. M., et al.
Marianhua: tetrahydrocannabinol and related compounds, M. Lerner, 175
Marine molluscan genera of western North America, A. M. Keen, book review by G. D. Hanna, 635
Markert, C. L.: Lactate dehydrogenase isozymes: dissociation and recombination of surface, 641
Markowitz, H.: See Tapp, J. T.
Marks, P. A. See Weinstein, I. B., et al.
Marler, P.: book review of The mountain gorilla, 106
Marks, B. P. See Chanoack, R. M., et al.
Marsh, J. T., et al.: Poliomyelitis in monkeys: decreased susceptibility after avoidance stress, 1414
Marsilea vestita: conversion of the water form to the land form by darkness and by far-red light, J. J. Gaudet, 975
Marton, T. W.: book review of Elsevier's dictionary of general physics in six languages: English/American, French, Spanish, Italian, Dutch, and German, 288
Marx, E. N.: book review of Infrared absorption spectroscopy, practical, 648
Maskelnyite: formation by explosive shock, D. J. Milton and P. S. De Carli, 670
Matchett, J. R.: book review of Recent advances in food sciences, vols. 1 and 2, 247
Mateles, R. I. See Lim, P. G.
Mathematical discovery on understanding, learning, and teaching problem solving, vol. 2, H. Polyka, book review by L. C. Young, 886
Mathematics, S. Rapprot and H. Wright (Eds.), book review by L. R. Wilcox, 1978
Mathematics: the man-made universe, S. K. Stein, book review by L. R. Wilcox, 1298
Mathes, M. C.: Antimicrobial substances from a tissue grown in vitro, 1101
Maxwell, J. G. (Ed.), See Basic problems in geoelectronics.
Mayr, E.: Animal species and evolution, book review of, 628
McCall, G. See Forstort, F. A.
McDonald, J. E.: Stratmospheric cloud over northern Arizona, 292
McElroy, W. D.: Protein structure and function during differentiation (meeting report), 142
McGowan, J. A. See Fager, E. W.
McKee, B.: book reviews: Basic problems in geoelectronics, 656; Reviews in engineering geology, I, 287
McKeever, W.: Creativity and the indigent student (letter), 211
McKinney, J. P.: Disappearance of luminous designs, 46
McKie, P.: Manpower or mindpower (letter), 1154
McLaughlin, S. C., Jr.: Missing links in computer intelligence (letter), 212
McVittie, G. C.: Channel 37 (letter), 1174
McWhan, D. B. See Geller, S., et al.
Mead, G. W.: book review of The fishes, 626
Measure of the moon, The, R. B. Baldwin, book review by D. Alter, 374
Measurement of a visual motion aftereffect with the flash, T. R. Scott and D. A. Powell, 57
Mechanisms of organic and enzymic reactions, S. G. Waley, book review by M. L. Bender, 1111
Memory (meeting report), 82
Membrane permeability: monolayer relationships, A. A., et al. Membranes, 824
Memory (meeting report), A. W. Melton, 82
Menstrual cycle influences grooming behavior and sexual activity in the rhesus monkey, R. P. Michael and J. Herbert, 500
Menzies, I. S.: Space program skepticism (letter), 937
Mery, H.: Cells: their structure and function, book review of, 623
Meryman, H. T.: Bench vs. desk: dilemma for the creative scientist (letter), 1150
Metcalf, R. L. See Geography, G. P.
Metabolism of the brain, R. L. McCoox, 822
Methotrexate: suppression of experimental allergic encephalomyelitis, M. W. Brandt, 181
Methylmalonate excretion in vitamin B12 deficiency, L. A. Barness et al., 76
Metric system of measurement (letters), N. A. Weber; D. V. Frost, 112
Meyers, W. J., et al.: Heart rate changes after reinforcing brain stimulation in rats, 1233
Michael, H. N. (Ed.) See Ethnic origins of the peoples of northeastern Asia
Michael, H. N.: Menstrual cycle influences grooming behavior and sexual activity in the rhesus monkey, 500
Michels, R., et al.: Thyroxyne: effect on the amino acid incorporation into protein in vivo, 1417
Miodownik, J.: 799 of calcium by aequorin luminescence, O. Shimomura et al., 1339
Microfossils in Wisconsin loess and till from western Illinois and eastern Iowa, R. L. Jones et al., 1222
Microphotography of fossilized teeth, R. W. Wyckoff et al., 78
Miles, W. R.: Chimpanzee behavior: review of the research from companion's eye (abstr.), 383
Milker's nodules: isolation of a poxvirus
INDEX TO VOLUME 140

R

Rensangri, R. Burling, book review by C. E. Cunningham, 1387
Reovirus and wound-tumor virus: serological cross-reactivity, G. Streissle and R. K. Mandrosch, 814
Repeatability of Jupiter's deccametric radio emission, J. W. Warwick, 814
Replicating form of a single-stranded DNA virus: physical and properties, M. Hayashi et al., 1311
Rescigno, A. See Slater, J. V., et al.
Research at the Moscow Medical Stomatological Institute (letter), T. B. Coolidge, 855
Research centers, Function of (letter), R. F. DeHaan, 1362
Resonant particles in high-energy physics (meeting report), C. L. Yu, 1430
Resources in America's future, H. LANDSBERG et al., book review by G. S. Tolley, 971
Restrictive research fund policies (letter), B. MacMahon, 208
Retention in immediate memory estimated without retrieval, H. Buschks, 56
Reutilicye protein synthesis: response of the polyuridylic acid, I. B. Weinstein et al., 1348
Reversal of thyroxine-induced hypermetabolism by puromycin, W. P. Weiss and L. Sokoloff, 1324
Reviews in engineering geology, vol. 1, T. FLUHR and R. F. LEGGOTT (Eds.), book review by B. McKee, 287
Rhododendrons: aspects of their assembly and concentrations in precipitation, M. W. M. Leo and A. Walton, 1398
Ribosomes: a common structural feature, R. Langridge, 1000
Rifkin, A. H.: Violence in human behavior (meeting report), 904
RNA in learning and memory (abstr.), R. W. Gerard et al., 381
Roberts, L. S.: Fish flour (letter), 1155
Robinson, T., The organic constituents of higher plants, book review of, 633
Roche, M. H.: Polygamic de surface, book review of, 659
Rochow, T. G.: book review of Progress in microscopy, 655
Rock, I., and G. Steinfeld: Methodological questions in the study of one-trial learning, 822
Rodriguez de Lorez Arnaiz, G. See De Robertis, E., et al.
Roeder, K. D., Nerve cells and insect behavior, book review of, 633
ROHEN, J. W., Primatology, vol. 2, No. 1, pt. 6, 630
Role of ferrodoxin in the energy conversion process of photosynthesis (abstr.), D. I. Arnon et al., 378
Romner, A. S.: International Congress of Zoology meeting—preliminary announcement, 1113
Root hairs, cuticle, and pits, F. M. Scott and E. S. Bohn, 415
Root, V. M.: Society of Technical Writers and Publishers (Affiliate), 830
Rose, J. E. See Kastner, J., et al.
Rose, R. D. See Weber, F. N., Jr., et al.
Roth, J., et al.: Hypoglycemia: a potential stimulus to secretion of growth hormone, 987
Rothman, M. A.: Missing links in computer intelligence (letter), 212
Rowe, W. P. See Friedman-Kien, A. E., et al.
Rowlands, D. T., Jr. See La Via, M. F., et al.
Roy, R. See Dachille, F., et al.
Russell, L. B.: Mammalian X-chromosome action: inactivation limited in spread among region, J. L. Yui, 976
Russian-English Chemical and Polytechnic Dictionary, L. I. CALLAHAM, book review by M. Hoseh, 654
Rutenberg, A. C.: Xenon fluorides: fluorine-19 nuclear magnetic resonance spectra, 993
RYSCHKEWITSCH, G. F., Chemical bonding and the geometry of molecules, book review of, 645
R

S

Sachs, R. G.: Can the direction of flow of time be determined?, 1284
Saferman, R. S., and M.-E. Morris: Algal virus: isolation, 679
Sager, R., et al.: Coding ambiguity in gel-free extracts of Chlamydomonas, 304
Saiga, Y. See Shimomura, O., et al.
Salganicoff, L. See De Robertis, E., et al.
Sargent, G. D. See Bartlett, P. D.
Sastry, K. S., and R. M. Muir: Gibrereillen: effect on diffusible auxin in fruit development, 494
Say, M. G. (Ed.): Concise encyclopaedia of electronic engineering, book review of, 285
Scavenger probe sampling: a method for studying gaseous free radicals, R. M. Fristrom, 25
Schaller, G. B.: The mountain gorilla, book review of, 1081
Scharrer, E. A., and H. W. Deane: More paper work, less research (letter), 721
Schlegel, A. E.: book review of Fundamental problems in turbulence and their relation to geophysics, 44
Schindler, D. W. See Comita, G. W.
Schirosa, mansoni: development of challenge infections in mice exposed to irradiated cercariae, A. P. Szumlewicz and L. J. Olivier, 411
Schwartz, R. S., and L. Beldott: Hemol-ogous disease reactions by x-radiation, 171
Science and politics, Lord Halslass, book review by D. K. Price, 622

Electroencephalogram, J. P. Zubek and L. Wilgosh, 306
Proposed important mental tools for scientific thinking at the high school level (abstract), W. Shockey, 384
Protein structure and function during differentiation (meeting report), W. D. McElroy, 1427
Pseudopregnancy in rats (letters), E. Eichner, A. L. Doyle and A. J. Margolis, 1136
Psychological implications of word usage, J. C. Nunnally and R. L. Flaugher, 775
Public Health Service. See News and comment
Quantitative molecular approach to the permeability changes of excitation, A. M. Shanes, 51
Quantum mechanics, vol. 1, Old quantum theory, S. TOMONAGA, book review by G. E. Uhlenbeck, 886
Quiet crisis in India, J. P. Lewis, book review by E. Staley, 641

INDEX TO VOLUME 140 xvii
INDEX TO VOLUME 140

Werner, S. L. See Ward, R. F.
West Ford dipoles, Orbital lifetime of (letter), H. M. Jones et al., 1173
West Ford needles. See News and comment
Westman, R. A.: Somatic inheritance of habituation of responses to light in planarians, 676
Westfall, R. S.: book review of Isaac Newton, historian, 642
Wethering: Education and research (letter), 570
Westphal, J. A. See Murray, B. C., et al.
Wexler, H. (Eds.): Antarctic research, book review of, 474
Whales, E. J. Slijper, book review by J. C. Moore, 166
Wharton, G. W.: Nature of science (letter), 762
What machines cannot do (letter), H. Orlans, 1156
When universities become publishers, C. G. Bowen, 599
Whicker, F. W. See Hanson, W. C., et al.
Whipple, E. B. See Brown, T. H., et al.
White, L. P., and E. F. Clafin: Nitrogen mustard: continuity of toxicity in axenic mice, 1400
Whitworth, J. W. See Muzik, T. J.
Wildy, R. L. See Murray, B. C., et al.
Wilgosh, L. See Zubeck, J. P.
Wilhelmi, A. E. See Goldstein, J. H., et al.
Wilkins, H. P.: Moon maps, book review of, 475
Williams, M. H. F.: Molecular configuration of nucleic acids, 941
Williams, C. M.: Control of pupal diapause by the direct action of light on the CNS (absr.), 386
Williams, L. P.: book review: Nobel prize winners in chemistry, 623; The lying stones of Dr. Johann Bartholomew Adam Beringer, 1083
Williams, R. J.: Nutrition in a nutshell, book review of, 800
Williamson, S. M. See Gunn, S. R.
Wilson, H. L. See Walker, J. S., et al.
Wilson, J. A. See Steinberg, A. G.
Wilson, J. M. See Burdette, W. J., et al.
Wilson, L. R.: book review of Lower Cretaceous plant microfossils from Minnesota, 1300
Wilson, O. C.: Stellar chromospheres evolve? (absr.), 386
Windle, W. F.: Neuropathology of certain forms of mental retardation, 1186.
See Munroe, J.
Wisotzky, L. J.: see: Phosphorescence of rat kidneys cooled in liquid nitrogen, 671
Wiss, O. See Weiser, H., et al.
Witt, H. N.: Education and research (letter), 570
Witten, L. (Ed.): Gravitation: an introduction to current research, book review of, 659
Wolfe, D.: AAAS financial report, 1241; editorials: Piecework pay for professors, 355; President's manpower report, 15; Science fairs, 1055; University responsibility, 861
Wolfrom, J. L., et al.: Glycoside formation with a nonacylated glycosyl halide (absr.), 386
Woltjer, L.: book review of Soviet science of interstellar space, 659
WOLTJER, L. (Ed.): The distribution and motion of interstellar matter in galaxies, book review of, 657
Wood, J. L., et al.: Foreign literature of chemistry, 610
Woodford, A. G.: book review of Alexander von Humboldt, 973
Wright, H. E., Jr. See van Zeist, W.
Wurtman, R. J. See Axelrod, J., et al.

X

X-ray analysis of hemoglobin, M. F. Perutz, 863
X-ray sensitivity and DNA synthesis in synchronous populations of HeLa cells, T. Terasima and L. J. Tolmack, 490
Xenon fluorides: fluorene-19 nuclear magnetic resonance spectra, A. C. Rutenber, 919
Xenon oxyfluoride, D. F. Smith, 899
Xenon tetrafluoride: fluorene-19 high-resolution magnetic resonance spectrum, T. H. Brown et al., 178
Xenon tetrafluoride: heat of formation, S. R. Gunn and S. M. Williamson, 177

Y

Yalow, R. S. See Roth, J., et al.
Young, D. G. See Barnes, L. A., et al.
Young, H. E.: Education and research (letter), 570
Young, L. C.: book reviews: Mathematical discovery on understanding, learning, and teaching problem solving, vol. 1, 886; Studies in mathematical analysis and related topics, 286
Yuan, L. C.: Resonant particles in high-energy physics (meeting report), 1430

Z

Zak, R. See Gordon, P.
ZAKATOV, P. S.: A course in higher geodesy, book review of, 1301
Zanchetti, A. See Carli, G., et al.
Zeolite ZK: A new molecular sieve, G. T. Kerr, 1412
Zeto, R. J. See Dachille, F., et al.
Zimmem, G. D., and J. D. Demis: Burns and other skin lesions: microcirculatory responses in man during healing, 994
Zooplankton species groups in the North Pacific, E. W. Fager and J. A. McGowan, 453; erratum, 923
Zubay, G.: Molecular models for protein synthesis, 1092
Zubeck, J. P., and L. Wilgosh: Prolonged immobilization of the body: changes in performance and in the electroencephalogram, 306
Zwilling, E.: book review of Growth, including reproduction and morphological development, 638
MNEMOTRON's Correlation Computer System (CC-1) consists of the COR-256 combined with the Computer of Average Transients (CAT 400B). This system performs real time auto- and crosscorrelation computations, thereby permitting the study of statistical properties of repetitive signals buried in random noise.

The Correlation Computer generates up to 256 points of the auto- or crosscorrelation functions. On-line operation eliminates the need for time consuming and costly data analysis. Results computed by the system are immediately available as an oscilloscope pattern. Accessory units make results available as an analog plot or a printed or punched digital readout.

Reliability, portability and long life are benefits of the Correlation Computer's transistorized circuitry and modern packaging techniques.

See us at the Federation Meeting, Atlantic City — Booths 73-74.

ALL MNEMOTRON computers and accessories are available through purchase or through a Lease-Purchase agreement that permits rental for as short a period as 6 months. A MNEMOTRON Engineer will gladly demonstrate the computers' capabilities in your laboratory. Write, wire or phone for an appointment.

Executive Sales Offices: 202 Mamaroneck Ave., White Plains, N.Y.
The volume is a reprint, without change of pagination, of the papers as they were published in the *Journal of Geophysical Research* [67, No. 8 (July 1962)].

Most of the papers are concerned with meteorological problems, but many, particularly the fundamental theoretical papers, are of more general interest. Some are related to turbulence in the ocean.

At any rate, the volume gives a useful picture of the present development of turbulence theory and of its possible applications to geophysics.

A. E. SCHEIDEGGER
Department of Mining, Metallurgy, and Petroleum Engineering
University of Illinois

New Books

**Biological and Medical Sciences**


---

**Note**

**Geophysics**

**Fundamental Problems in Turbulence and Their Relation to Geophysics**


Although the contributors represent many countries, including the United States, the U.S.S.R., Japan, and Germany, all of the papers are in English.
MECHANICAL TARING

greatest breakthrough in laboratory weighing since the single-pan balance!

The new Model 2623 analytical balance is another FIRST from SARTORIUS.

With this instrument, built-in weights are used for mechanical taring up to capacity—which is 100 grams. In other words, any vessel (beaker, flask, tube, etc.), or other supporting medium for the sample—even papers weighing only a few milligrams—can be tared to the fourth decimal place (0.1 mg). And the actual weighing of a sample proceeds from a scale and counter system which reads ZERO. When weighing-out solutions or powders, the procedure can be reversed so that the balance is pre-loaded with any desired amount. Again, the weighing proceeds without regard for the container. Calculations are eliminated, the possibility of reading errors is reduced and the entire procedure is completed in just seconds; if another vessel is needed, one can also readjust to a new tare value in seconds.

For users who really need taring facilities, this system is much faster and much simpler than any taring technique which involves a manual adjustment of weights. With the 2623, you dial-in the tare—just as you dial-in the weight.

For complete descriptive literature, please contact:

sartorius

BRINKMANN INSTRUMENTS, INC.
115 Cutter Mill Road, Great Neck, N. Y.

PHILADELPHIA - CLEVELAND - HOUSTON - MIAMI - MENLO PARK, CAL. - ST. LOUIS

5 APRIL 1963
Collect accurate data in less time with these reliable Nuclear-Chicago instruments

The instruments shown here can satisfy many of your needs in radioactivity counting equipment. Whether you want a simple gas-flow detector or an automatic spectrometry system, Nuclear-Chicago offers an instrument to do the job reliably, conveniently, accurately, and efficiently. Consult your Nuclear-Chicago sales engineer for information.

Gamma counting

Gamma emitting isotopes can be analyzed faster and with better precision using Nuclear-Chicago manual or fully automatic gamma counting systems. These advanced systems are designed around high-efficiency scintillation detectors. They are available with a wide variety of pulse-height spectrometers engineered specifically for gamma discrimination. The lead shielding supplied is more than adequate to maintain a low background level.

Model 1070 Automatic Sample Changer is the instrument of choice for laboratories analyzing many small-volume, solid or liquid gamma samples. It handles up to 50 samples in bottles or test tubes and can be used with Nuclear-Chicago's 2-inch or 3-inch well scintillation detectors. The simple and rugged changer mechanism with its minimum number of moving parts provides long, trouble-free life even under continuous operation.

Tobor is the practical solution to many of your gamma-counting problems especially if your samples vary in volume or if they are as large as laboratory animals and human forearms. Measurements with Tobor are highly reproducible because counting efficiency is uniform over a wide range of sample volumes. Sodium iodide crystals or plastic scintillators up to seven inches in diameter can be furnished.
**Radiochromatography**

The data producing capabilities of analytical radiochromatography now can be expanded through the use of Nuclear-Chicago’s new systems for qualitative and quantitative determinations. These versatile systems detect and record radioactivity in paper, liquid-column, or gas chromatography procedures.

**Liquid scintillation counting**

The new Series 6720 liquid scintillation spectrometry systems permit routine, accurate counting of any sequence of carbon-14 and tritium samples with efficiencies as high as 90% and 40% respectively. The systems offer important time-saving conveniences: fast data print-out, automatic calculation of counts per minute and channels ratios, large capacity sample changer, and selective sample programming. The Series 6720 three-channel analyzer is uniquely suited to the short-duration pulses produced by beta particles.

**Automatic planchet counting**

Nuclear-Chicago’s automatic planchet counting systems for solid-phase beta emitting isotopes insure precise geometrical reproducibility for every sample. Each system is offered with monitoring instruments that provide fast digital read-out of time, count, and sample number, as well as automatic calculation of counts per minute.

---

**Model 1032 Actigraph** is the only strip chromatogram scanner that offers 4-pi detecting geometry with a choice of window or windowless operation. By scanning both sides of the strip, the Actigraph virtually doubles the sensitivity of the 2-pi method and delivers correspondingly higher resolution. Efficiencies of 10% for carbon-14 and 2% for tritium can be obtained with a background of 15 counts per minute or less. Paper strip loading is simple, and gas consumption is low.

**Models 6724 and 6725** are automatic systems with controlled-temperature chambers that maintain optimum counting environment for up to 150 samples. A solid-state, three-scaler/timer provides preset time, preset count, or time/count.

**Proved reliability** has established Model 1040 as the most widely accepted sample changer for samples of 1/z inch diameter or smaller. The instrument will automatically handle over 70 samples. It can be operated with a windowless or thin-window gas-flow detector. Low-energy beta samples require minimum background rates for best accuracy. Model 1046 system effectively delivers this accuracy by reducing net background to less than 2 counts per minute. It utilizes the same dependable automatic changing mechanism as Model 1040.

**Models 6722 and 6723** are room-temperature versions of the Series 6720. They handle 50 samples automatically with only a small sacrifice in counting efficiency. A single-sample manual system, Model 6733, is also available at moderate cost.

**Model 1100** accommodates samples as large as 2 inches in diameter, and can be equipped with magazine extensions for a maximum capacity of 150. The large-area gas-flow detector used with this automatic system permits more sample to be placed on the planchet so that a high count rate can be achieved for low-activity samples.

---

*Nuclear-Chicago Corporation*

349 East Howard Avenue, Des Plaines, Illinois • Telephone 312 827-4456

**SALES OFFICES:** New York, Boston, Washington, Philadelphia, Atlanta, Chicago, Minneapolis-St. Paul, Cleveland, Dallas, Los Angeles, San Francisco, Denver, Toronto
From Beckman—first with a purged instrument to go to 185 m\(\mu\), then first to go to 170 m\(\mu\)—comes another major advance in far-ultraviolet spectrophotometry. With the new Far UV DK-2A, you can perform analyses all the way to 160 m\(\mu\). It's a 15 m\(\mu\) bonus over competitive instruments.

The Far UV DK-2A goes to the other extreme, too—3500 m\(\mu\). This is the widest continuous wavelength range commercially available! The Far UV DK-2A covers it with resolution of 0.2A for emission studies and 0.5A for absorption studies at 210 m\(\mu\). Consider also: 7 separate scanning speeds, multiple wavelength scale expansions, single-switch selection of 11 different chart ordinate presentations. Plus a wide variety of accessories.

Your Beckman Laboratory Dealer has the full Far UV DK-2A story. Also facts on the Far UV DK-1A if you want the same range in a strip-chart recording instrument. And for work in the 185-3500 m\(\mu\) region, ask about the DK-1A with strip-chart recorder or DK-2A with flat-bed recorder. Contact him or write direct for Data File LUV-98-163.
Kodak reports on:

“That new coding system” ... Mr. Gibson’s pictures ... guidance for the slightly puzzled shopper

Microfilm that responds intelligently

It will be like playing the piano or the typewriter. The mind works through the fingers. The hand never touches the microfilm. The roll carrying thousands of page-images is inside a cartridge. The player will pick a cartridge and insert it. He will spell out his instructions on the keyboard: “Show me everything you have that is coded ‘116’ in the first field and also carries the concept ‘beryllium’ in the fourth field but only if dated earlier than 4/15/58. Then deliver me a full-size paper copy of all pages of each document so specified. Correction: copy only the first page of each such document. Go.” And it will go, and the copies will fall out at the slot at the top, and then the microfilm will retreat back into its cartridge.

It is already working for one large customer. The whole outfit, including the camera that microfilms the documents and encodes the film, will sell right off the shelf for about the annual cost of two or three well-trained secretaries.

For details, write Recordsak Corp. (Subsidiary of Eastman Kodak Company), 770 Broadway, New York 3, N. Y., or phone John Eager there and when he asks why you are calling, reply “That new coding system.”

Fluorescence in the infrared

Here is an ordinary photograph of gallstones and here they are by fluorescence in the near infrared.

Here are some plant fragments and a chunk of greenockite by infrared infrared reflection, and visible fluorescence.

Illumination for the fluorescence shots was blue-green light with all the infrared filtered out. In front of a KODAK RETINA Reflex Camera loaded with KODAK High Speed Infrared Film, a KODAK WRATTEN No. 87 Filter passed only radiation longer than 740mμ. To record infrared reflection instead of infrared fluorescence, we removed the blue-green-passing, infrared-absorbing filter from the lamp, left everything else the same, and cut exposure time 20,000 times.

A man at Eastman Kodak Company, X-ray Sales Division, Rochester 4, N. Y. is the expert on this. His name is H. Lou Gibson. Write him if you like.

Is it an amide? Is it ether? Does it contain sulfur?

There are some 4100 EASTMAN Organic Chemicals. That’s not really very many, probably less than 1% of all organics that chemists know well enough to call “chemicals.” Chemists also recognize that the easy availability which arbitrarily distinguishes these from the other 99+% is an important consideration in planning laboratory work. We and the customers would love to see the measly 1% raised.

One factor that limits the growth rate of the business (and hence of the list) is the groping that so many prospective customers have to do in finding what they want among all the names we might possibly be calling it. We see no early prospects of licking this problem. It’s even worse for scientific workers who are not organic chemists and not schooled in Chemical Abstracts nomenclature, with which for better or worse we have cast our lot.

With pity for courageous wanderers through the 221 alphabetical pages of our catalog (“EASTMAN Organic Chemicals, List No. 43”), we have lit a feeble candle. For those who know nothing whatever of organic chemistry it will shed little light, but such have no business buying EASTMAN Organic Chemicals anyway. This second edition of “EASTMAN Organic Chemicals Classified by Functional Groups” (it replaces an earlier candle of the same name, now sputtered out) is being mailed to all who automatically receive each new alphabetical catalog and to anybody else who requests it from Distillation Products Industries, Rochester 3, N. Y. (Division of Eastman Kodak Company). Those who do not already have List No. 43 should say so.

This is another advertisement where Eastman Kodak Company probes at random for mutual interests and occasionally a little revenue from those whose work has something to do with science.
Meetings

Memory

Memory was the topic of ten invited papers of new research findings, a symposium, and the vice-presidential address by the retiring chairman of the Psychology Section (I) at the AAAS Philadelphia meeting in December 1962. The major emphasis was on human memory and within this emphasis the principal focus was on short-term human memory.

The session of invited papers contained a variety of significant investigations. On the issue of the distinction between very-short-term stimulus traces and encoded memory traces, a reinforcement of earlier findings on distinctions between preperceptual and postperceptual (memory) traces was made. Evidence was presented that showed the memory span is greatest for digits, next for letters, and shortest for colors or shapes, and that these differences are related to differences in the time required for reading those items from the brief visual presentation plus the very-short-term visual trace (Jane F. Mackworth, Defense Research Medical Laboratories). Further discussion on the same general problem dealt with the testing and confirmation of the notion that the perceptual encoding of even a small number of dots in a two-dimensional field is sequential rather than parallel. A procedure of stimulus-trace erasure had been used to obtain these data (Emanuel Averbach, Bell Telephone Laboratories).

Several papers described the effects of repetition on short-term memory. A talk on associative memory over brief intervals of time showed an interaction of the interval between repetitions of a word-number pair and the retention interval (up to 16 seconds) in determining recall; also noted was an optimum retention interval of 8 to 16 seconds between the two repetitions prior to a 16-second recall interval (Lloyd R. Peterson, Indiana University). In discussions on immediate memory as a function of repetition, results of experiments which utilized immediate free recall of a list of 30 words were described. It was found that words occurring twice were recalled better than words occurring only once, but that this effect was not a function of the number of other words intervening between the repetitions nor of the number of repeated words in the list when
the number was greater than one. These beneficial effects of repetition were, however, present only when the subject was primed to recognize the repeated words (Nancy C. Waugh, Harvard University). Another experiment with paired letters in which the letter pairs had either low or high initial associative strength showed that recall (after 1 or 7 days) increased directly as a function of frequency of repetition. However, contrary to interference theory, recall was the same for the two types of list even though, consistent with the theory, the extra-experimental intrusion errors in recall were identifiable as previously established letter-sequence habits (Benton J. Underwood, Northwestern University).

One study involving the continuous presentation and recall of paired associates revealed the facilitating and inhibiting effects in short-term recall of mixing or keeping homogeneous the categories of words attached to the same or different letter stimuli (L. Starling Reid, University of Virginia). Arguments and evidence for considering recall as determined not only by previously established associations, but also by the logical processing of these memory data were presented. In support of the former a report was made on the rather extraordinary capacity of human subjects for discriminating the order of occurrence of events in the past (temporal "tags"); in support of the latter, a repetition of the Broadbent experiment on short-term memory in dichotic listening showed that the order of report was determined by the kind of event rather than the ear involved (Douwe B. Yntema, Massachusetts Institute of Technology).

Single presentation of a series of word-number pairs (or nonsense-syllable-number pairs) and recall after varying intervals up to days showed that associations involving low arousal (basal metabolism rate) at the time of presentation suffer the usual forgetting over time but that associations involving high arousal were inhibited at short retention intervals and gain in apparent strength over time. These findings were then related to the "consolidation" theory of memory traces (Edward L. Walker, University of Michigan).

A final report was aimed primarily at the methodology of memory studies. The first experiments utilized a forced-choice technique, which is designed to circumvent or manipulate the strong effects of response bias in the now widely-employed Shepard and Teght-
soonnish method used for studying con-
tinuous recognition memory. The meth-
od appears to be an elegant technique
for this purpose and is applicable
wherever the elimination or control of
response bias is essential to the match-
ing of theory and experiment (Roger
N. Shepard and Jih-Jie Chang, Bell
Telephone Laboratories). In quite a
different vein, other data on the reten-
tion of single events stressed the vari-
ability of retention performance as a
function of time (Edward A. Bilodeau,
Tulane University).

The symposium on Experimental-
Theoretical Approaches to Memory
was intended to set in juxtaposition
the approaches of the neurophysiolo-
gist, the psychologist working within
the framework of communication con-
cepts and mechanisms, the psychologis-
working within the traditions of stimu-
lus-response functionalism and the
psychologist working with the new tools
for computer-modeling of behavior
mechanisms. The principal emphases
were concerned with: the "consolida-
tion" hypothesis regarding fixing of
neural traces for permanent storage
(Ralph W. Gerard, University of Mich-
igan); the dichotomy of short-term and
long-term memory storage based prin-
cipally on the non-dependence of the
former on the similarity relations of
disrupted and disrupting activities and
the well-known dependence of the lat-
ter on such relations (Donald E.
Broadbent, Applied Psychology Re-
search Unit, Cambridge); the issues
raised by evidence that the interference
theory of forgetting predicts too much
forgetting (Leo Postman, University of
California); and the fertility and guid-
ance value of logical, quantitative mod-
els, such as are suitable for realization
on a computer, for theorizing about
memory and learning (Earl B. Hunt,
University of California).

The vice-presidential address by
Arthur W. Melton was the final event
in this series on memory. After identi-
fying a number of current issues in
learning theory as issues about the for-
mation, storage, and retrieval of mem-
ory traces, the major general issue was
identified as the question whether short-
term memory and long-term memory
are points on a continuum. An affirm-
itive answer was expressed, based not
only on the data of others who have used
the method of recall of single to-
be-remembered items following a single
or very few repetitions, but also on new
data that relate the slope of the
short-term forgetting curve to the num-
ber of elements or encoded "chunks"
in the to-be-remembered unit. Also,
new data confirming and extending
Hebb's repetition effect in the context
of the memory-span experiment were
cited as support for the continuity of
short- and long-term memory. The
principal consequence of this conclu-
sion was suggested as the extension of
the postulate of permanence of memory
traces to include the permanence of
traces established by single occurrences
of events in the life of the organism,
although the data also seem to suggest
preferences among the alternative as-
sumptions offered as solutions to other
critical issues in general theory of
memory.

The vice-presidential address, the
symposium papers, and a number of
the other invited papers will be pub-
lished in a special issue of the Journal
of Verbal Learning and Verbal Be-
behavior.

ARTHUR W. MELTON
University of Michigan, Ann Arbor

Forthcoming Events

May

2-5. Cytoplastmic Streaming, Cell Move-
ment, and Salutatory Motion of Subcellular
Particles, symp. Princeton, N.J. (R. D.
Allen, Dept. of Biology, Princeton Univ.,
Box 704, Princeton)

3. Astronomy and the Peaceful Uses
of Space, Evanston, Ill. (J. A. Hynek,
Astronomy Dept., Northwestern Univ.,
Evanston)

3-4. Colorado-Wyoming Acad. of Sci-
cence, Fort Collins, Colo. (R. G. Beidle-
man, Dept. of Zoology, Colorado College,
Colorado Springs)

3-4. Endocrinology, 2nd intern. congr.,
Hospital, Whitechapel, London, E.1)

3-4. Minnesota Acad. of Science, St.
Paul. (M. R. Boudrye, 1821 University
Ave., St. Paul 4)

3-4. Nebraska Acad. of Sciences,
Lincoln. (C. B. Schultz, 101 Morrill
Hall, Univ. of Nebraska, Lincoln 8)

3-4. North Dakota Acad. of Science,
Grand Forks. (B. G. Gustafson, Univer-
sity Station, Grand Forks)

3-5. Prototides of the Biological Fluids,
11th colloquium, Bruges, Belgium. (H.
Peeters, St. Jans Hospital, Bruges)

3-5. Wisconsin Acad. of Sciences, Arts
and Letters, Milwaukee. (T. J. McLaugh-
lin, Univ. of Wisconsin, Milwaukee 11)

3-6. American Psychoanalytic Assoc.,
St. Louis, Mo. (H. Kohut, 664 N. Mich-
igan Ave., Chicago 11, Ill.)

3-6. International Soc. of Craniofacial
Biology, annual, Miami Beach, Fla. (S.
Pruzynsky, Univ. of Illinois, 808 Wood
St., Chicago 12)

4-5. Academy of Psychoanalysis, an-
nual, St. Louis, Mo. (A. H. Rifkin, 125 E. 65 St., New York 21)
5-8. American Inst. of Chemical Engineers, Buffalo, N.Y. (F. J. Van Antwerpen, American Inst. of Chemical Engineers, 345 E. 47 St., New York, N.Y.)
6-10. Atmospheric and Space Electr., 3rd intern. conf., Montreux, Switzerland. (H. R. Byers, Dept. of Geophysical Sciences, University of Chicago, Chicago 37, Ill.)
6-10. American Industrial Hygiene Assoc., conf., Cincinnati, Ohio. (G. D. Clayton, 14125 Prevost, Detroit 27, Mich.)
6-10. Psychiatric Soc., 119th annual, St. Louis, Mo. (R. L. Robinson, APA, 1700 18th St., NW, Washington 9)
7-8. Histochemical Soc., 14th annual, Washington, D.C. (M. Wachstein, Dept. of Pathology, St. Catherine's Hospital, Brooklyn 6, N.Y.)
7-9. American Soc. of Lubrication Engineers, Chicago, Ill. (M. M. Gurgio, Humble Oil Co., P.O. Box 2180, Houston 1, Tex.)
8-10. American Assc. of Chemists, Philadelphia, Pa. (J. Kotrady, American Inst. of Chemists, 60 E. 42 St., New York 17)
8-12. National Science Education Exposition, New Mexico Acad. of Science, Albuquerque. (The Academy, 5900 Domingo Rd., NE, Albuquerque)
9-14. American Inst. of Industrial Engineers natl. meeting, Denver, Colo. (W. J. Jaffe, Newark College of Engineering, Newark, N.J.)
12-14. Excerpta Medica Foundation,

CAREER APPOINTMENTS

NASA

ELEVEN PH.D.'S FOR NEW KEY POSITIONS

The Astrophysics Division, NASA Marshall Space Flight Center, is expanding rapidly and seeks eleven scientists and engineers with Ph.D. degrees in physics, mathematics, electronics, and aeronautical engineering.

GUIDANCE & CONTROL

Five positions are available in the following areas:
1. Consultant, advisor and special assistant to the Director, Astrophysics Division, with responsibility for research and development requiring the adaptation and application of engineering and scientific methods, concepts and theories in connection with the electrical, magnetic, thermal mechanical and other physical properties of materials used in guidance and control.
2. Studies of various types of guidance schemes and recommendations as to which to apply to different missions based on accuracy, reliability, cost, etc.; detailed studies of other NASA space vehicle guidance systems to provide support and cross-coupling of technical information.
3. Investigation of forces and torques for control of future space and launch vehicles and analysis of proposed methods and hardware; flight control studies to determine vehicle maneuvering power and impulse requirements.
4. Technical advice on extremely complex problems relating to mathematical-physical relationship of vehicle dynamics on space boosters; studies to obtain empirical data for use in solving flight dynamics problems; recommendation of new techniques and theories for consideration in design and development of components.
5. Formulation of equations of motion which describe the flight and guidance performance of space vehicle systems. Formulations will include deviation of steering functions and their mechanismization as well as deviation involving theory of inertial, radio, and navigational principles. Mathematical analysis of orbital and interplanetary guidance schemes will also be performed.

FRICTION & LUBRICATION

Studies of gas bearing characteristics and application of resulting theories to advanced gas lubricated bearing designs; special studies on aerodynamic problems encountered in gas bearing research; comparison of analytical approaches with the characteristics of air bearing hardware as a basis for theory refinement.

ELECTRONIC FLIGHT & SUPPORT EQUIPMENT

Application of display systems to the launch site computer complex; discern what should be displayed within a checkout and monitoring sequence and propose methods of display which present the operator with the status and operational quality of a system.

MEASUREMENT & INSTRUMENTATION SYSTEMS

Consultant, advisor, special assistant to Chief, Instrumentation Development Branch, with responsibility for research and development requiring application of engineering and scientific methods in studies of RF systems and aerospace communications; will receive special assignments relating to unprecedented projects on theory and development of vehicle instrumentation and aerospace communications systems.

HEAT & LIGHT MEASUREMENT

Design and development of complex electronic, electrical, and electromechanical components, apparatus, devices, materials and parts required for guidance and control systems of space vehicles; advisor and physical researcher in quantum electronics and quantum physics; investigation of possibility to construct optical frequency counters or new devices for performance of guidance and communication functions.

SENSORS & TRANSDUCERS

Seek solution to theoretical problems related to gyro and accelerometers; perform studies on gyro performance parameters and apply the results to gyro dynamic analysis; analyze gyro motor characteristics and application of results to new gyro designs.

AUTOMATED CONTROL SYSTEMS

Establish mathematical and analog simulation methods for analysis of gyro and gimbal axis suspensions; establish basic approaches for research and development of inertial sensing and measuring elements.

Send your résumé to: Mr. William Vassil, Dept. DNC-1, NASA Marshall Space Flight Center, Professional Staffing Office, Huntsville, Alabama.

NASA is an equal opportunity employer. Positions are filled in accordance with aerospace Announcement 232-B.

5 APRIL 1963