SCIENCE

29 October 1965

Vol. 150, No. 3696

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

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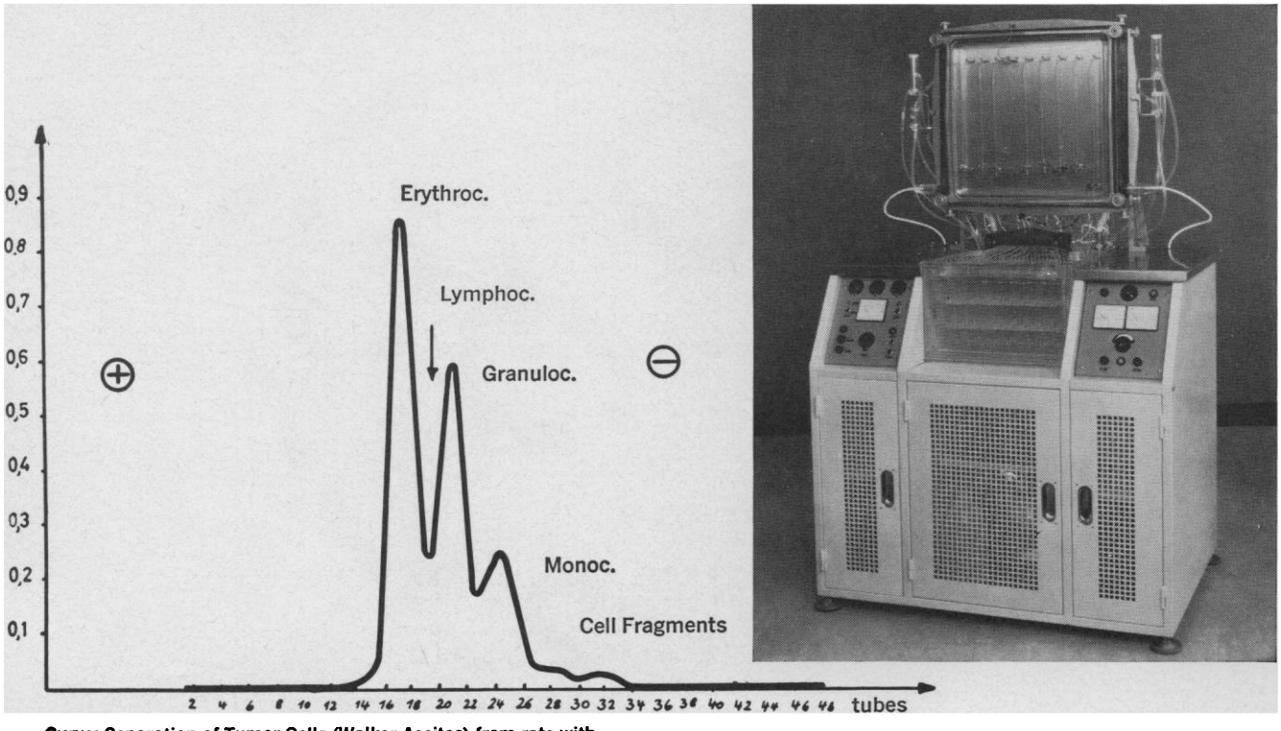

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SCIENCE

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

Chromosomes in meiosis. This strange anthropomorphic configuration appeared at prometaphase in a microsporocyte. A ring of six chromosomes creates the outline of the "face." Four bivalents form the "eyes," "nose," and "mouth," giving a chromosome number of $2n = 14$. This anomaly is one outcome of a study of reciprocal translocations in chromosomes of *Gayophytum eriospermum* (about $\times$ 5200). [Leonard B. Thein, University of California, Los Angeles]

Steroid analysis?

Beckman chromatographs perform – even on submicrogram samples

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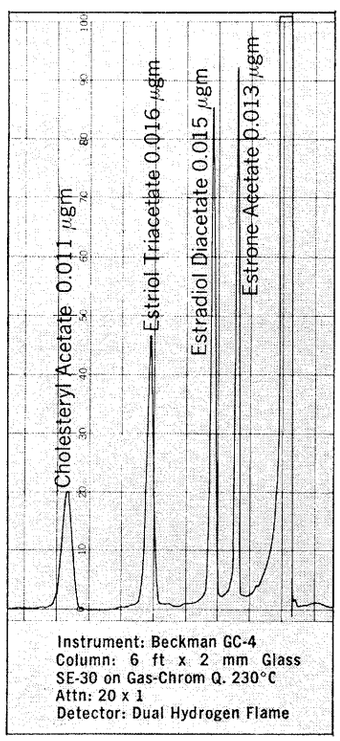
To find out more about Beckman Chromatographs, see your local Beckman Sales Engineer. Or write for Data File LGC-166.



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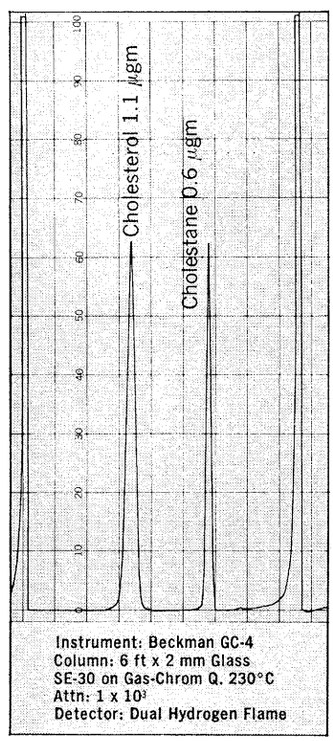
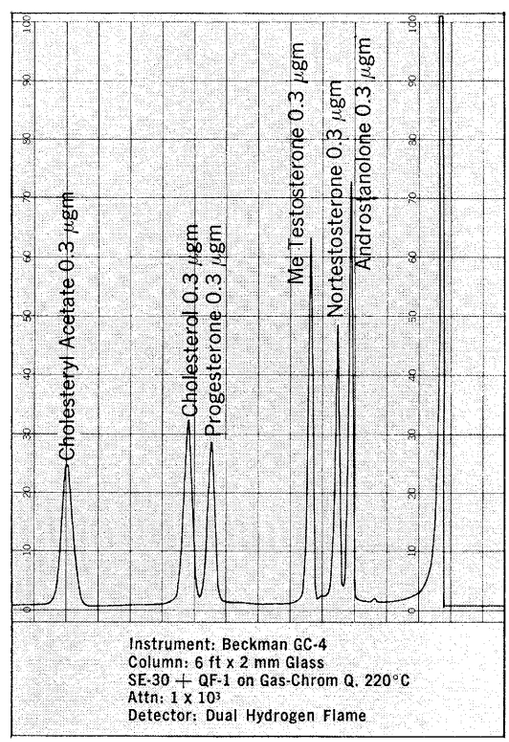


Minimum tailing. Note the peak symmetry and lack of tailing on a 1.1 microgram sample of cholesterol. The base line between cholesterol and cholestane peaks indicates no decomposition of cholesterol to cholestadiene.



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Kodak reports on:

orthographical support for the Harvard team . . . sweetening the odds for radiography . . . a reward for wetting the fingers

A hydrocarbon of unnatural shape

The finest one of the freshest crop of organic textbooks calls "tryptycene." This spelling ignores the suggestion from the Department of Classics at Harvard to the team of Harvard chemists who first prepared the rigid, 3-fold-symmetrical, propeller-like hydrocarbon in 1942. Classical scholars like triptychs better than propellers. We support the Harvard team orthographically and announce *Triptycene* (EASTMAN 9739) at the low, low price of $15.50 for 10 grams, which is about ⅛ what we have seen the compound advertised at a year ago.

The timing of this announcement is interesting. The generation that learned about triptycene in graduate school has now been out long enough to have made a small start toward paying off their mortgages, and their employers are daring to hope they will soon start thinking about practical matters. Here and there chemical thinking in three dimensions is being applied to such matters, whereupon the eminently non-planar triptycene comes to mind.

In medicinal chemistry, for example, studies have been published on the effect of non-planarity in the aromatic blocking group that constitutes one end of many different pharmacological agents. In the absence of evidence that triptycene occurs anywhere in nature, would there be sinister implications if this work should eventually lead to something taken internally to extend human life or comfort? Another school of chemists—those who work on colorants—take an obvious interest in how odd steric configuration might govern the behavior of their traditionally flat molecules toward light and substrates. Whatever excitement they may feel at being propelled in profitable directions by this hydrocarbon propeller, they remain outwardly calm.

Within the short time for this to reach print, we may also be offering derivatives of triptycene with a handle on the bridgehead for fastening to other moieties. Ask the source of all EASTMAN *Organic Chemicals for the laboratory, Distillation Products Industries, Rochester, N. Y. 14603 (Division of Eastman Kodak Company). The catalog of these wares has a new supplement, No. 43-4. We hope all who need it have it.*

Price subject to change without notice.

The writer shows his teeth

Only a very small minority of readers of these words will ever have occasion to specify a brand of x-ray film.* We have other ways of getting hot news to them while it is still hot. The x-ray film news has now cooled off enough to be properly digested among the general populace. A dentist in Lima, Ohio has written to our president suggesting that we allay the radiation fear by publicizing the news about our "fast film" and how it permits him now to take a complete series of 14 exposures with one-half the radiation he formerly needed for a single exposure.

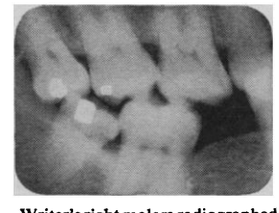
Perhaps we should, but we are not wholly sure. We certainly don't want to be caught pooh-poohing. Philosophy and commerce have long irritated each other. Philosophical geneticists who irradiate insects and mice and then warn us against crippling our great-great-great-grandchildren irk some busy practitioners who just want to stay busy. So do patients who stray too far in their reading from the sports or society page.

There are also other practitioners. Time is well spent in cleverly hunting one of them down. Having found him, trust him. He recognizes the case and the means for gonadal protection during radiology no less than he recognizes the undeserved compliment that genetic considerations imply for patients past a certain age.

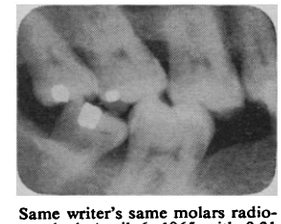
Between genetic peril and somatic peril lies a comfortably huge gap of many, many millirads. It comforts those practitioners who might otherwise be philosophically troubled in recommending radiography to lengthen the odds against false teeth and twisted limbs and backs and unarrested diseases in the chest, gastrointestinal tract, and kidneys.

Humanity, the physicians and dentists, and we in the radiation business owe a considerable debt to the alarmists for the wide use today of fast fluorescent screens that let the film be exposed 95% by excited light and only 5% by x-rays, of filtration techniques that block off radiation too long in wavelength anyway to help the visualization—and of fast film, if we are to be permitted candor.

Don't send for a booklet. Don't march into a physician's or dentist's office and demand x-rays. Just stay reasonable on the subject.



Writer's right molars radiographed September 24, 1952 with about 5.5 roentgens.



Same writer's same molars radiographed April 6, 1965 with 0.21 roentgen.

Tone in photomicrography

Another special-interest group of film buyers thinly represented in the present audience are professional portrait photographers.† We now discover that a new film primarily designed for them, KODAK LS Pan Film (ESTAR Thick Base), happens to be ideally suited to the needs of that more thickly represented subset who require photomicrography.

We think here of photomicrography that raises tougher problems than can be handled with the undeniably convenient picture-in-a-minute cameras. One pays with wet fingers in the darkroom for the privilege of fine control that yields a separation of tonal detail without which the picture might lack all point.

"LS" stands for long scale. This means it records specimens showing a wide range of brightnesses. It differentiates tones in both the very dark areas and the very light areas. The film comes in all the standard sheet sizes, has extremely fine grain, high resolving power, and acutance (ability to render edges sharp, which is something else). One crude reason it gives better pictures is that its .007″ thickness makes it lie flat. The ASA 50 speed is about the same as in KODAK PANATOMIC-X Film, but LS Pan Film responds far more sensitively to control through development.

Questions, including such a simple one as where KODAK *LS Pan Film can be purchased, will be answered by a photomicrographer named L. C. Wall, Eastman Kodak Company, Rochester, N.Y. 14650.*

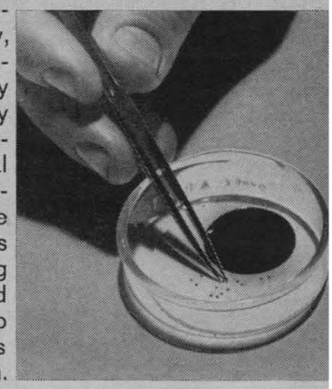
*Note to the small minority: in the unlikely event that you do not already have a fresh catalog of KODAK X-ray Films, please notify Radiography Markets Division, Eastman Kodak Company, Rochester, N.Y. 14650.

†Had the family and self professionally photographed of late? The years slip by. Another Christmas is coming. There is just enough time to book an appointment. Most people seem to find it a happier expenditure than for x-rays.

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

CIRCUIT DESIGNER'S DREAM

A transistor that would exhibit only the desirable parameters of both high and low resistivity starting materials used to be a circuit designer's dream. No more. Now he has the benefit of a discovery originally made by Bell Telephone Laboratories and engineered for production by Western Electric. □ The discovery: epitaxial growth. Bell Labs found that silicon tetrachloride vapors decompose and deposit pure crystalline silicon when they touch any surface with a temperature on the order of 1200° C; that if the surface happens to be pure crystalline silicon to start with, the deposit assumes all of its crystal lattice properties except its resistivity. That can be controlled by adding the proper impurity elements to the $SiCl_4$. □ Following this discovery, Western Electric engineers designed equipment that would deposit a high resistivity epitaxial layer on a number of low resistivity substrates at once. Each substrate could thereafter be cut up into several thousand individual transistor chips. It is this equipment, or equipment very much like it, which has now become the industry-wide standard. Such developments are to be expected from the close working relationship between Bell Laboratories and Western Electric. It is progress dedicated to the continuing improvement of the world's finest communications system—the Bell System.



Western Electric
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as the predictors and the first-year college physics grades as the criterion. After data on over 1000 students had been collected, scattergrams of a random sample revealed little or no correlation between either mathematical or verbal scores and final grades.

The data on these students were recorded separately for each institution, unlike Holland's data in his study of Merit Scholars. (Chauncey and Hilton say that the lack of correlation reported by Holland may have resulted from combining a large number of colleges.) True, as Chauncey and Hilton pointed out in connection with Holland's study, three different admissions policies resulted in three populations; but the correlations for each were negligible. At one college, students with mathematical-aptitude scores ranging from 730 to 800 (very respectable indeed) earned grades from A to D; with verbal-aptitude scores of 710-730, grades ranged from A to E. Correlations were no higher for the mathematical-aptitude scores and final grades than for verbal, though the criterion was a physics grade!

With no correlation between predictors and criterion, my study never got off the ground. Though comparative performance of PSSC and traditional physics students was not determined, the data indicate the existence and importance in academic achievement of factors other than mathematical and verbal aptitudes, and thus support Terman and Oden and refute Chauncey and Hilton.

I question the value of attempting to discriminate among students of high ability; many conversations with college admissions officers and personnel people indicate that any student capable of scoring 650 or above on the CEEB aptitude scores is capable of satisfactory performance in college work. It seems to me that we ought to be expending our efforts to determine why some academically talented students do not earn grades commensurate with their ability and what we can do about it.

GLADYS S. KLEINMAN
Graduate School of Education,
Rutgers University,
New Brunswick, New Jersey

Legacy of the Flexner Report

In his account of the expanded leadership role of the Association of American Medical Colleges (News and Comment, 25 June, p. 1700), John Walsh remarks: "The legacy of the famous Flexner Report . . . was the reform of the medical schools and improvement in the quality of research."

Most of us in medicine have been led to believe that the Flexner report created a considerable revolution, which affected the field of medicine for many years. Many so-called marginal medical schools no doubt disappeared; education for the doctor of medicine improved, and research was given a much needed shot in the arm.

Did this, however, seriously change the quality of attention given to the health of the great majority of the people? Did the marginal medical school disappear only to be replaced by the osteopathic and chiropractic schools? Is not a large percentage of medical care today, especially in rural areas and small communities, rendered by practitioners of healing arts that are based on faulty, to say the least, understanding of pathology? Has anyone ever made a clear-headed study of the kind of medical care the great mass of the American people receives?

Unquestionably the more sophisticated and well-to-do segment of our population takes advantage of the better education given to our doctors of medicine. But what about the great mass of people?

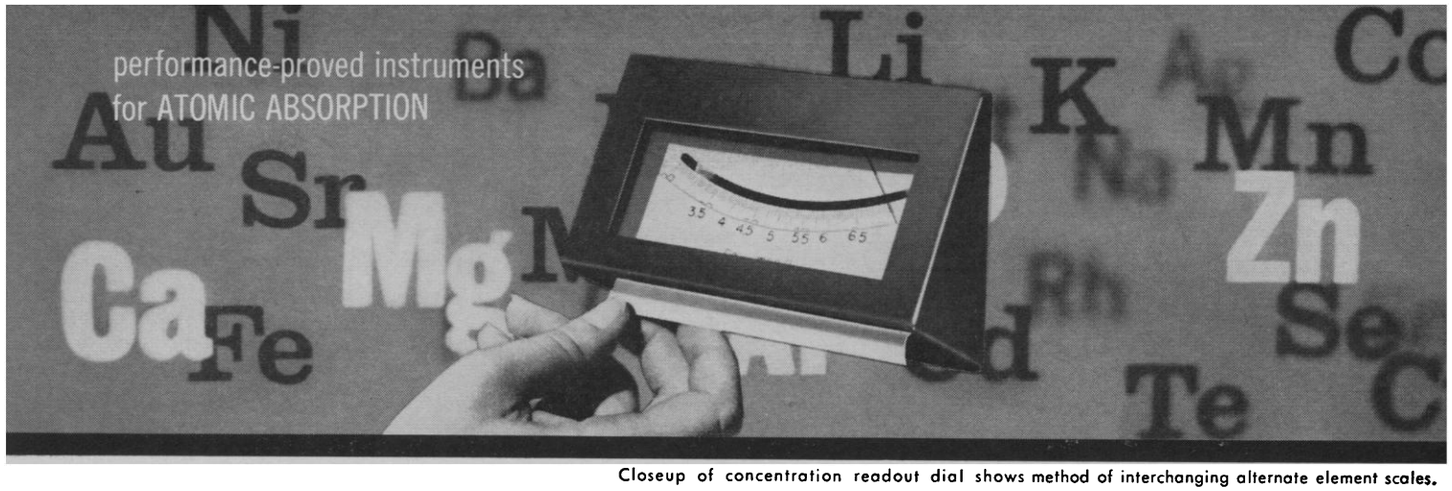
JOHN T. FLYNN
Beekman-Downtown Hospital,
170 William Street, New York 10038

Webs

The article "Spider-web building" (10 Sept., p. 1190) impressed me and brought to my mind a verse in the Psalms (90:9) that reads, "We spend our years as a tale that is told." I once said to a friend that this means "like a long continued story." "You are wrong," he said. "It means counting the years, like a teller in a bank counting money." Some years later, when I had acquired a knowledge of Hebrew sufficient to consult a dictionary, I looked up the Hebrew words and found to my astonishment that the Psalm read, "We spend our years like a spider"—spinning our webs of life.

The article in *Science* brought this all back to me (*aet.* 91).

FRANK ALLEN
606-59 Wilmot Place,
Winnipeg 13, Manitoba



Closeup of concentration readout dial shows method of interchanging alternate element scales.

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- Operates with complete freedom from spectral interferences and a minimum of matrix interferences.
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Compact (25" x 15" x 12") and self-contained, the Model 290 reads out concentration directly on a five-inch meter, which incorporates interchangeable scales. No conversion tables or calculations are required. An AC system eliminates spectral interference. The grating monochromator insures high energy. Gas controls are built in. The stable, almost inaudible pre-mix burner handles higher dissolved solids than any other burner. The instrument can be used with an external recorder, which will also read out in concentration. The Model 290 handles many elements impossible of determination by flame photometry. In the analysis of alkalis and alkaline earths, the Model 290 outperforms flame photometry in precision, accuracy and specificity.

The Model 290 is backed up by free customer training courses at Perkin-Elmer. For complete information, including specifics on the Model 290 applied to your needs, write the Perkin-Elmer Corporation, 723 Main Avenue, Norwalk, Connecticut.

(Prices subject to change without notice.)

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After the Manned Lunar Landing?

Throughout history the moon has had a special place in man's consciousness. Archeological evidence indicates that prehistoric man was highly aware of the moon and its changing phases. The literature of all ages contains many references to the moon. Our satellite is still an object of unusual psychological significance. Who has not had a sense of awe and grandeur in watching a rising full moon? Its special role in emotional matters is evidenced by many popular songs of this era (see page 594). No other object in the sky—not even the sun—has received more attention. Small wonder that the adventure of traveling to the moon commands continuing interest and support. This backing seemed not to flag even when the Ranger pictures showed a desolate lunar landscape.

The deep world-wide interest in exploration of the moon gives the effort great propaganda value. Simultaneously, interest in scientific information concerning the satellite has been heightened. Such knowledge serves to increase the probability of successful missions. Also, the information is interesting in its own right. The results from unmanned missions so far have served more to stimulate curiosity than to provide answers. The pictures sent back by Rangers 8 and 9, while magnificent, have raised more questions than they have settled. It is clear that many features of the lunar surface were produced by meteorite impact. However, the pictures have not ruled out the possibility that volcanism has played a role. The presence of slump structures has been attributed by some to volcanism. Others think the structures have resulted from subsurface sublimation of ice.

The major question of the origin of the moon is no closer to being answered. Was the moon captured by Earth, or was the satellite once part of Earth? Soft-landed unmanned vehicles will provide more information about the moon, while raising new questions. Manned exploration and the return of samples to Earth may be necessary to resolve some of the puzzles.

To date the purely scientific results from our manned space program have not been impressive. With good reason, the engineering and medical aspects have been given overriding priority. In effect, our manned space program has consisted of a series of great technological stunts. One is reminded of an acrobatic act where spectators are awed by a series of difficult feats. The acrobatic team must constantly increase the complexity of its act in order to hold the audience's attention. If the John Glenn mission were repeated today, how much attention would it receive?

The Space Agency is now well advanced in its progress toward a lunar landing. Increasingly, planners are considering follow-on programs. These include more grandiose efforts toward manned exploration of the moon and attempts to explore Mars. Will the Space Agency be able to devise a continuing series of spectaculars of ascending dramatic quality? I think not. The first successful landing on the moon will be a climax. Just as succeeding climbs of Mt. Everest, after the first ascent, have drawn diminishing attention, later lunar travel will lose its novelty.

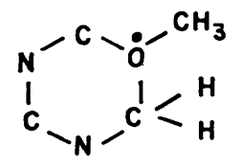
As for Mars, how many popular songs have been written about it? On euphonic grounds alone, the paucity is not surprising—*bars, chars, jars.* More fundamental is the question, "How many people know where Mars is, or even care?" Perhaps man will one day go to the planet, but the psychological and emotional impact of the trip will be pale in comparison with that of the first successful landing on the moon.

—PHILIP H. ABELSON

in the radical concentration, not second order as would be expected for radical recombination. He suggested that the radicals might combine either with hydrogen atoms moving through the lattice or with electrons. In the ensuing discussion, no really satisfactory alternative to this hypothesis was presented.

Mueller also discussed the difficulties in measuring absolute radical yields by electron-spin-resonance. In 1961 a number of laboratories interchanged standards and found that there were differences of a factor of two in the absolute numbers measured by various laboratories. The source of this discrepancy is under active investigation at Karlsruhe and Utrecht, two laboratories which were far apart on the initial exchange.

Robert Schulman (Bell Telephone Laboratories) talked about the work which is being done at the Bell Telephone Laboratories on identifying the radicals produced in DNA by ultraviolet light. Irradiation of dry DNA with ultraviolet light at 77°K gives a strong singlet, and a much smaller component showing a number of lines which can be unequivocally linked to thymine. If the sample is irradiated in the presence of moisture, the thymine signal can be made to dominate the observed signal. The Bell Telephone Laboratories group postulates that this radical is



They have also identified a phosphorescent emission from thymidine which is quenched when the thymidine is in DNA in the native state. The level giving rise to the phosphorescence was unequivocally identified as a triplet state. There were speculations on the possible connection between these results and the formation of the thymine dimer in ultraviolet-irradiated DNA.

Thormod Henriksen (Oslo) reviewed the introduction of ESR signals into dry protein by ionizing radiations. At very low temperatures a broad, featureless signal is produced which is best interpreted as the superposition of many different free radicals. On warming to room temperature, the observed pattern goes through a series of changes until it gradually resolves into

two relatively distinct signals—a broad signal having a *g*-factor somewhat more than 2, associated with sulfur atoms, and a doublet having a *g*-factor equal to that of the free electron. In several special cases, including crystals of various amino acids and in silk fibers, this doublet has been identified as a radical on the alpha carbon atom located in the polypeptide backbone and bonded to a single hydrogen atom. This might suggest that the glycines were being preferentially attacked.

The connection between radiation-induced ESR signals and biological activity, as shown in studies on trypsin irradiated in the dry state, was discussed by Peter Alexander (London). He suggested that a major inactivating event in the case of proteins could be the removal of an amino acid residue from the polypeptide chain. This concept is certainly in good agreement with the doublet signals described by Henriksen. It was, however, pointed out that the postulated breakage of the bond between the alpha and beta carbons is unexpected.

Tolbert (Colorado) summarized information on the radiation chemistry and radiation biochemistry of proteins irradiated in the dry state. From the chemical data, Tolbert concluded that there is only a difference of a factor of 2 or 3 in radiosensitivity for destruction of various amino acids in irradiated proteins, and that there was no selective breakage of sulfur-sulfur bonds. There also does not seem to be any real evidence for breakage of the main polypeptide chain in most proteins. Warren Garrison (Berkeley) briefly reviewed his mechanism for chain breakage following the production of a free radical on the alpha carbon in the polypeptide backbone and gave evidence for this process in irradiated gelatin. No suggestion was advanced as to why this breakage apparently does not occur in other proteins, except that the free ends may sometimes recombine with each other.

Comprehensive studies on irradiated dry spores of *Bacillus megaterium* were presented by E. L. Powers (Argonne). These studies show excellent correlations between spore viability and a free-radical mechanism within the spore, as deduced from the effects of such reagents as oxygen, nitric oxide, or hydrogen sulfide, all of which have well known reactions with free radicals. Powers preferred to define free radicals on the basis of their chemical reactivity with such reagents. Other participants thought that definition of a free radical in terms of an unpaired electron was more satisfactory. The variations in spore survival could also be correlated with ESR measurements, although Powers was careful to point out that a large number of free radicals are created in a spore before it loses its ability to multiply, and that the free radicals responsible for spore inactivation probably consitute only a very minute fraction of those which can be measured by the ESR technique.

In the final session, Peter Alexander suggested that electron-spin-resonance was rather unlikely to give much of a clue as to what events were significant in causing the loss of biological activity of irradiated cells. On the other hand, he felt that the ESR technique had great potential for the understanding of details of events taking place once the key materials involved in the biological inactivation process had been identified. Alan Conger (Temple) echoed a rather similar idea when he said that he did not really care about the detailed interpretation of ESR signals. What concerned him was the location in which the ESR signals were found.

In summing up, E. C. Pollard (Pennsylvania State), chairman of the Subcommittee on Radiobiology, felt that it was clear that evidence of physical damage by radiation was plentiful, but that relating it to biological effects still seemed difficult.

The conference was sponsored by the subcommittee on radiobiology of the National Research Council. The complete proceedings, including the extensive discussion after each paper, will appear soon as an NRC publication.

FRANKLIN HUTCHINSON
Yale University,
New Haven, Connecticut

Forthcoming Events

November

7. American College of **Dentists**, Las Vegas, Nev. (O. W. Brandhorst, 4236 Lindell Blvd., St. Louis, Mo.)

7–9. American **Science Film** Assoc., annual, Washington, D.C. (ASFA, 1319 F St., NW, Washington 20004)

7–11. American Soc. of **Mechanical Engineers**, winter annual mtg., Chicago, Ill. (ASME, 345 East 47 St., New York)

7–12. **Anatomical Pathology**, 5th Latin American congr., Lima, Peru. (J. J. Andujar, P.O. Box 118, Fort Worth, Tex.)

7–13. **Paediatrics**, 11th intern. congr.,

Tokyo, Japan. (K. Nakamura, Dept. of Pediatrics, Univ. of Tokyo, P.O. Box 18, Hongo, Tokyo)

7–14. **Vienna Univ. of Technology**, 150th anniversary celebration, Vienna, Austria. (Technische Hochschule, Gusshausstr. 23, Vienna 4)

8–9. **Engineering in the Practice of Medicine**, Philadelphia, Pa. (S. Rosen, Dept. of Medicine, Hahnemann Medical College, 230 N. Broad St., Philadelphia 19102)

8–11. American **Dental** Assoc., Las Vegas, Nev. (H. Hillenbrand, 222 E. Superior St., Chicago, Ill. 60611)

8–11. **Insecticide and Fungicide**, 3rd British conf., Brighton, England. (Secretary, 140 Bensham Lane, Thornton Heath, Surrey, England)

8–11. **Nutrition**, Western Hemisphere congr., Chicago, Ill. (Dept. of Foods and Nutrition, American Medical Assoc., 535 North Dearborn, Chicago 60610)

8–11. **Quality Control**, intern. congr., Tokyo, Japan. (Union of Japanese Scientists and Engineers, c/o Sakata Bldg., 3 Muromachi 4-chome, Nihombashi, Chuo-ku, Tokyo)

8–13. Austrian **Medical** Congr., 19th annual, Vienna. (M. Schnardt, Osterreichische Arztekammer, Referat für Arztliche Fortbildung, Weihburggasse 10–12, Vienna I)

9–12. **Seismic Models**, symp., Prague, Czechoslovakia. (V. Karnik and J. Vanek, Inst. of Geophysics, Czechoslovak Acad. of Sciences, Bocni II, Prague 13-Sporilov)

9–13. Asociación Médica de Puerto Rico, Santurce. (J. A. Ramirez, 13–5 Fernandez Juncos Ave., Santurce)

10–11. Power Applications of **Controllable Semiconductor Devices**, conf., London, England. (Secretary, Inst. of Electrical Engineers, Savoy Pl., London, W.C.2)

10–12. American Soc. for **Cell Biology**, 5th, Philadelphia, Pa. (M. J. Moses, Box 2982, Duke Univ. Medical Center, Durham, N.C. 27706)

10–12. **Engineering in Medicine and Biology**, 18th annual conf., Philadelphia, Pa. (H. P. Schwan, Moore School of Electrical Engineering, Univ. of Pennsylvania, Philadelphia 19104)

10–12. **Isotope Techniques in the Hydrologic Cycle**, symp., Univ. of Illinois, Urbana. (G. E. Stout, Meteorology Section, Illinois State Water Survey, Univ. of Illinois, Urbana)

10–13. **Respiratory Therapy**, 2nd New England conf., Boston, Mass. (D. Crocker, Children's Hospital Medical Center, 300 Longwood Ave., Boston 15)

10–20. Development of **Petroleum Resources of Asia and the Far East**, 3rd symp., Tokyo, Japan. (S. Santitham, Rajadamnern Ave., Bangkok, Thailand)

11–12. **Kentucky** Acad. of Science, Univ. of Kentucky, Lexington. (D. M. Lindsay, Georgetown College, Georgetown, Ky.)

11–13. **Gerontological** Soc., 18th annual, Los Angeles, Calif. (W. D. Obrist, Dept. of Psychiatry, Duke Univ. Medical Center, Durham, N.C. 27706)

11–13. Bases for **Nuclear Spin-Parity** Assignments, conf., Gatlinburg, Tenn. (F. K. McGowan, Oak Ridge Natl. Laboratory, P.O. Box X, Oak Ridge, Tenn. 37831)

12–13. **Clinical Pathology of Infancy**, Assoc. of Clinical Scientists, Washington,