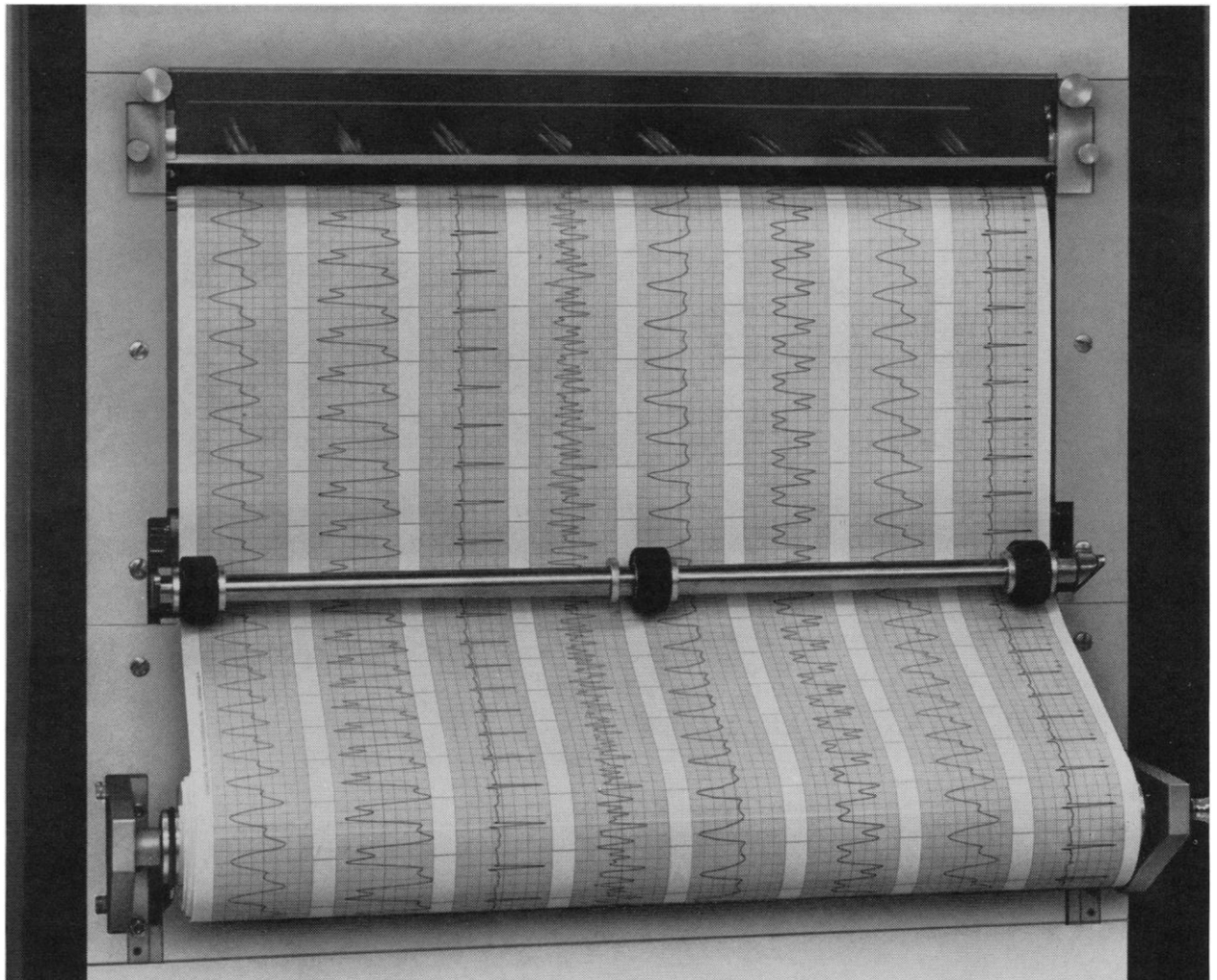
SCIENCE 13 December 1963
Vol. 142, No. 3598
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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COVER

A single thallus of the "Appalachian gametophyte" taken from sandstone rocks in Ohio. Mats of thousands of these plants, which are similar to liverworts, cling to rocks and trees over a large area of eastern United States north to Ohio and Virginia. It is evidently a fern from which the entire sporophyte generation has been eliminated. See page 1483.

digital-type reading

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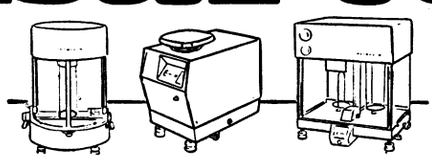

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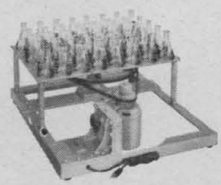

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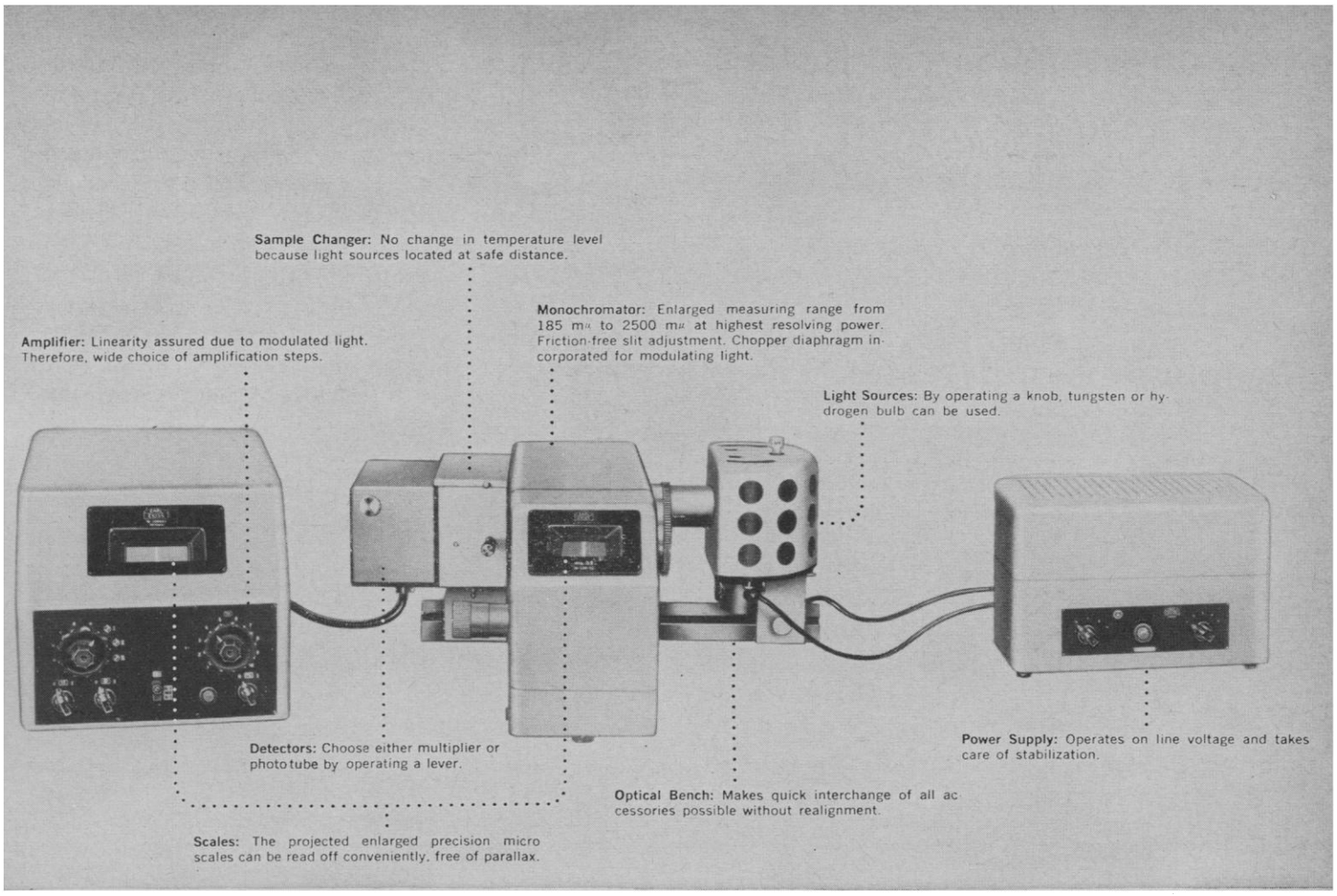

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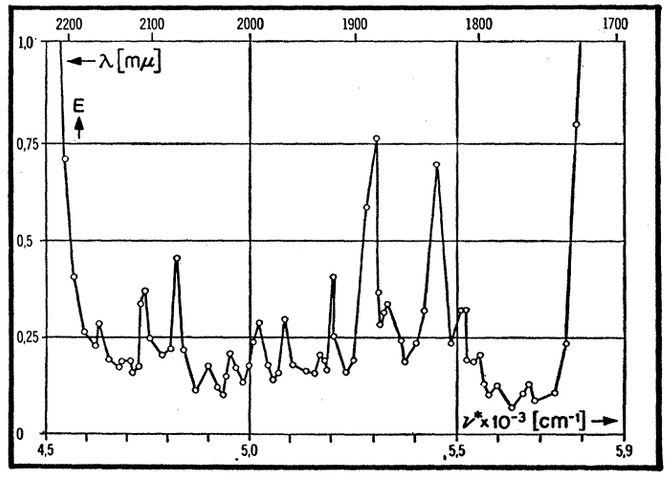

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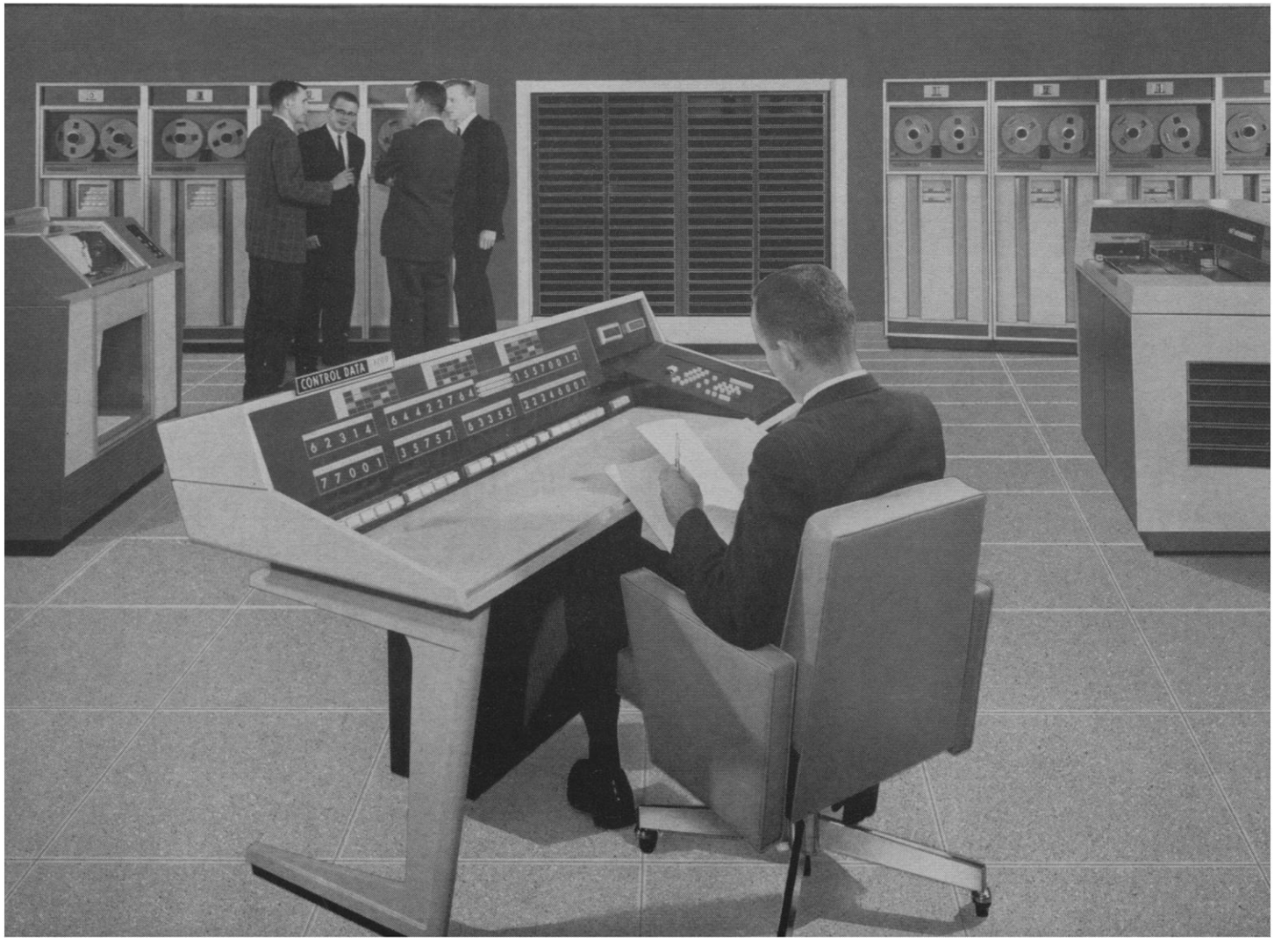

investigators working in nonprofit institutions. It would be disastrous were this system to change.

MELVIN BLECHER
Department of Biological Chemistry, School of Medicine, Georgetown University, Washington, D.C.

Your past editorials have always struck a strong sympathetic response with me. However, concerning your effort of 25 October 1963, might I ask that you expand your arguments of the last two paragraphs into a full article. It is tempting to think that you might talk yourself out of some of this folly in considering more fully the possible results.

C. K. BIRDSALL
Department of Engineering, University of California, Berkeley

. . . It is hard to separate prejudice for an established institution and an established investigator from prejudice for a specific proposal. Therefore, I propose the following change. . . . The scientific portion and the budget of the proposal should be easily separable from the identity of the individual principal investigator and the institution. . . . The study sections can then first weigh the scientific merits of each individual proposal and budget. The identity of the principal investigator and the institution can then be matched up with the proposal. The investigator and the institution can then be weighed. Some simple formula can be worked out whereby these three separate categories can be weighed together to yield an overall order for the proposals. . . .

ARTHUR M. WILSON
Department of Chemistry, Emory University, Atlanta 22, Georgia

The Noble Gases

In an article entitled "Some predicted chemistry of group VIII elements; the aerogens" [*J. Am. Chem. Soc.* **85**, 2202 (1963)], R. M. Noyes suggests the generic name "aerogens" for the inert gases because the latter designation has been made inappropriate by the recent synthesis of many chemical compounds of these gases. He bases his suggestion on an analogy with the term halogens, which he translates as "formed [*or* derived] from the salt of the sea." This is an erroneous derivation. "Halogen" means salt-forming or salt-former and refers to the unique property of the elements in question of forming salts directly with metals. The names oxygen, hydrogen, and nitrogen likewise mean acid-, water-, and niter-former, respectively.

The term "noble gases" is a very good substitute for "inert gases." (i) This name already exists in English chemical literature, and its German and Dutch translation (*Edelgas*) is the only word used in those languages for the inert gases; in French, *gaz noble* is a known substitute-name for *gaz inerte*. (ii) These gases are "noble" in the sense in which gold, for example, is a noble metal; that is, they react only in isolated cases. (iii) The term "noble gas structure" is frequently used, especially in physicochemical text books, to designate an electronic structure with eight electrons in the outer shell (two in the K-shell), which is found in the zero-group elements.

U. A. TH. BRINKMAN
Free University, Amsterdam, Netherlands

Virus and Pseudocowpox Disease

In the report by Moscovici *et al.* on the isolation of a viral agent from pseudocowpox disease [*Science* **141**, 915 (1963)] there is a lack of evidence that the virus, which was isolated in tissue cultures and characterized by various techniques, is actually the causative agent of the disease in question. It is evident that the new virus is capable of producing various effects in growing cells of bovine origin and is capable of surviving extensive passage through several generations in tissue culture, but these facts do not substantiate the suggestion of the authors that "the isolate is the etiologic agent of the pseudocowpox syndrome." The authors refer to an earlier report, "Milker's nodules: isolation of a poxvirus from a human case" by Friedman-Kien, Rowe, and Banfield [*Science* **140**, 1335 (1963)]. In the latter account there is likewise no evidence that the new isolate can produce pseudocowpox in cows or milker's nodules in man.

With the development of tissue culture as an instrument for isolation and study of viruses, many agents have been discovered in various animal and plant sources in complete absence of any disease or obvious pathologic changes. Discovery of the virus family in the human intestinal tract which

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13 December 1963, Volume 142, Number 3598 **SCIENCE**

By Scientists for Scientists

The publisher and editor of *Science* are frequently asked: What are your objectives with respect to the magazine? This is a good question and one to which we address ourselves often. We begin by considering our situation.

Members of the American Association for the Advancement of Science include many of the best personnel in almost every field of science. Among them are about half the members of the National Academy of Sciences and some of the top scientists in industry. Elsewhere in the world, outside the United Kingdom, our circulation matches that of *Nature*. There are about 95,000 subscribers and members, 15 percent more than a year ago. More indicative is that *Science* is noticed and read as few journals are. Our authors receive many requests for reprints. Not long ago an editorial mentioned an article by Alvin Weinberg. As a result, he received 1000 pieces of mail. Cover photographs have also attracted attention: 18 different authors have requested permission to use in their books a single photograph that appeared less than a year ago.

About 5000 scientists each year help in matters of editorial content. They prepare much of the material, judge it, and suggest how it can be improved. The editorial staff has freedom enjoyed by comparatively few, for we are not subjected to pressures from advertisers or from the officers of AAAS. *Science* has a potential speed of publication matching that of the news weeklies. Thus, we have an important audience, adequate scientific and financial support, and freedom of selection.

Our goal is to meet the needs of our readers, most of whom are individuals of broad interests who wish to be informed of notable developments outside their special fields. We attempt to do this by a number of mechanisms. First, there are announcements of new findings, in the reports section. These cover part, but only a fraction, of important developments. Through consultation with hundreds of leading scientists, however, we become aware of significant topics and then solicit articles to cover much of what otherwise might be missed. This effort is supplemented by publication of meeting reports and book reviews.

News of government has been of growing significance to many scientists. To meet the need, *Science* has the full-time services of three of the best reporters in Washington. They have opportunity to do the research necessary for thoughtful stories. Their material is not censored or arbitrarily edited.

Another function of *Science*, only partially developed, is that of serving as a means of communication among its readers. If there is to be an effective scientific community, its members must speak to each other. This communication can take the form of articles by individuals, or of summaries of reports of important committees. Often our editorials are a means of such communication, for they frequently express views shared by many of our readers. So, too, are letters to the editor. This section has been expanding, and the material submitted has increased, while improving in quality. Our goal in this area is to create a forum that the best minds will consider desirable and appropriate.

In summary, we wish to make *Science* a magazine of excellence which, at the same time, fills many of the intellectual needs of our members and draws them into solid fraternal relationship.—P.H.A.

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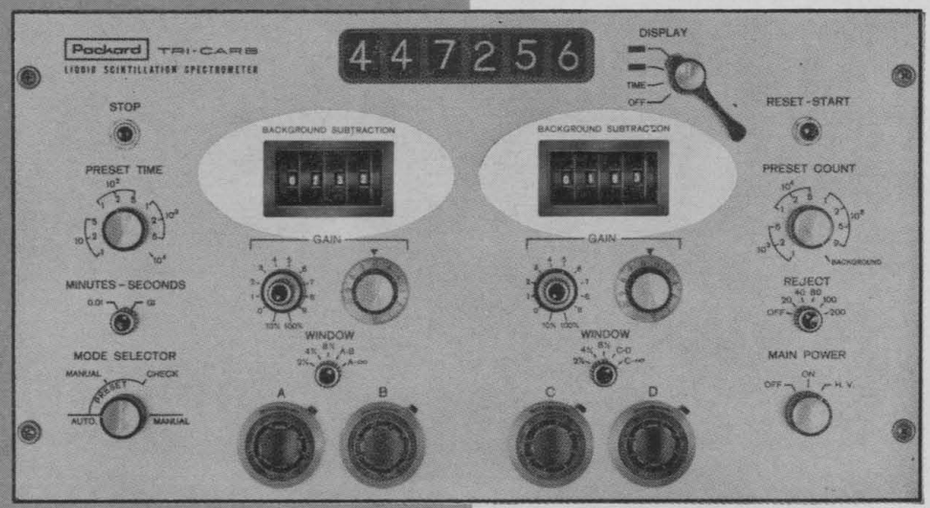

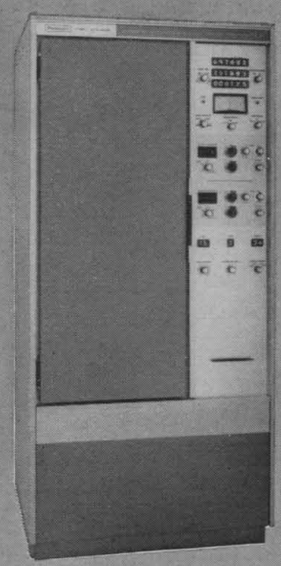

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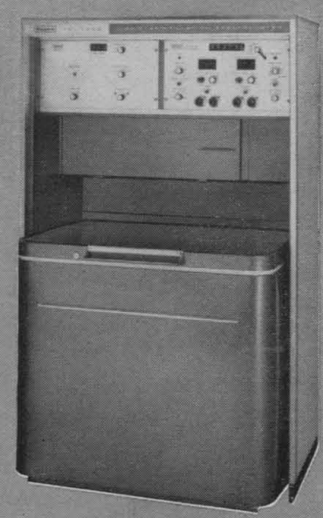

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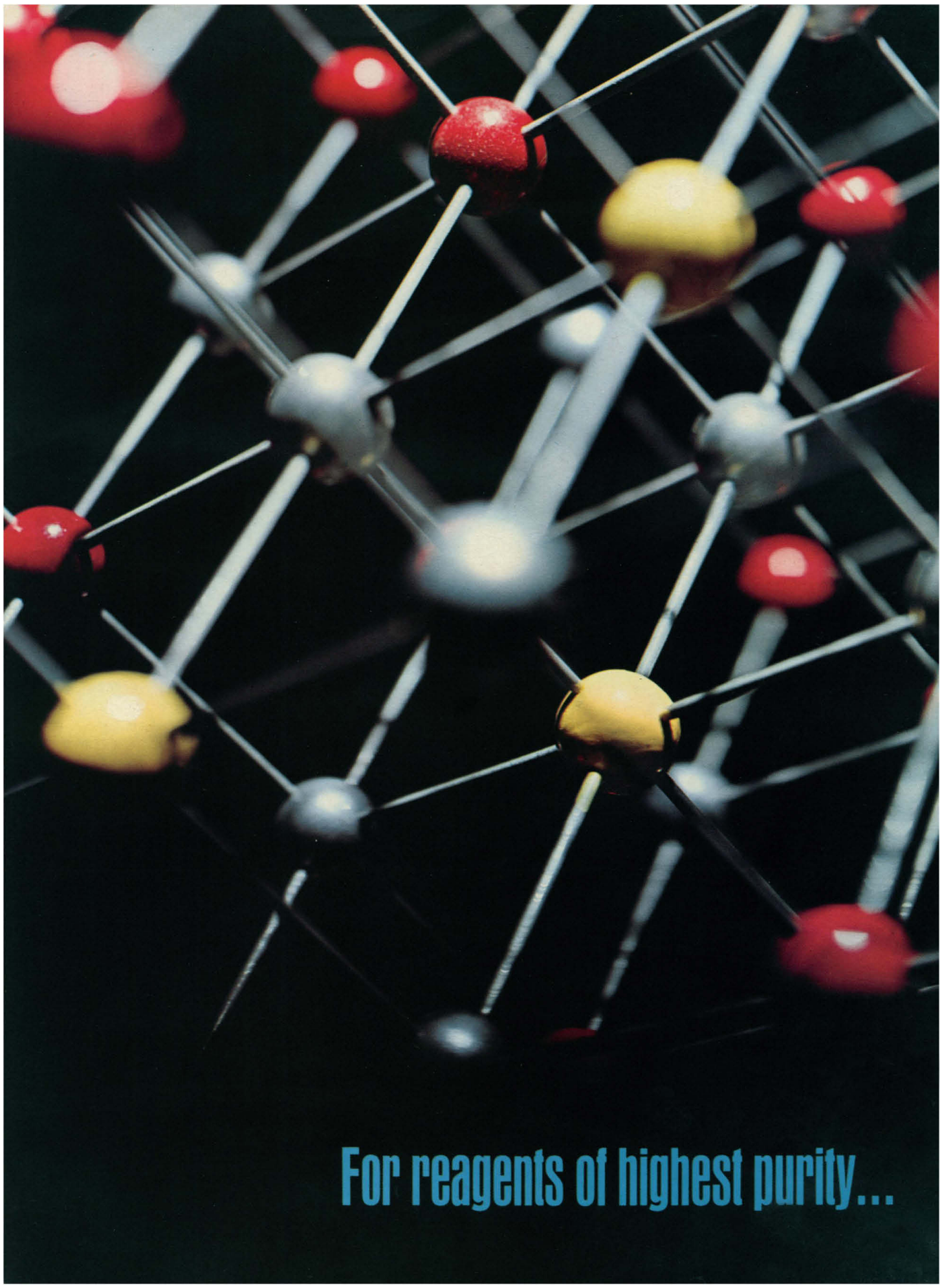
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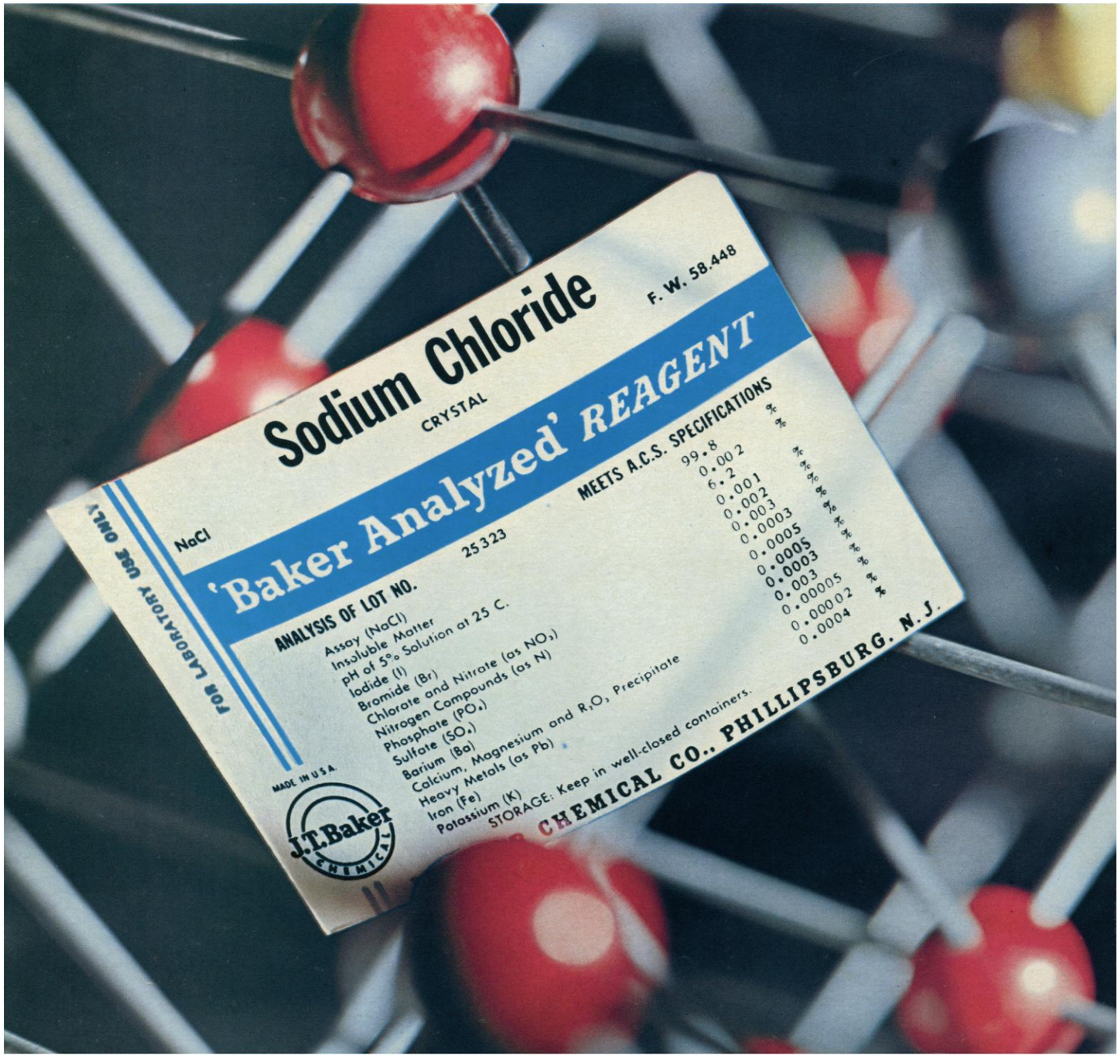

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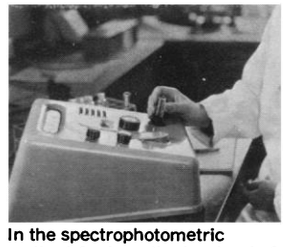

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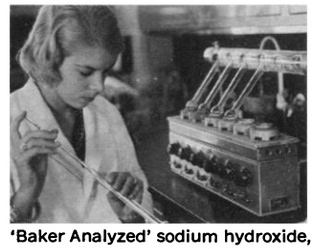

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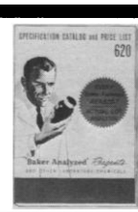

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Zwar and his colleagues also found that sublimation, which Beauchesne used as a purification step, may produce artifactitious kinins. It is possible that a conjugation between adenine and an amino acid could occur under conditions of sublimation. Thus, the compound of Beauchesne, also, may not be a native kinin.

The investigations just discussed were concerned only with the induction of cell division. F. C. Steward and E. M. Shantz (Cornell) have sought to resolve a related but more complicated phenomenon: the impressive growth of excised phloem tissue of carrot root when liquid endosperm of coconut is added to an otherwise defined medium. The main factors in coconut milk which act synergistically may now be specified as auxin, kinin, hexitols, and reduced nitrogen compounds. E. Maia (National Institute for Agronomic Research, Versailles) has isolated a carrot growth factor from tomato fruits. From another attempt to duplicate a particular growth phenomenon, in this case the growth of crown gall tissue, arose the investigation by H. N. Wood (Rockefeller Institute) of factors extractable from crown gall tissue of *Vinca rosea*, which induced cell division in pith tissue from tobacco stem. One of two factors, not yet obtained in pure form, has been tentatively identified as a compound of a nicotinamide-like residue and glucose sulfate.

So far, kinins have been defined and assayed in terms of their ability to induce cell division. It is also possible, in our present ignorance of their mode of action, to define and assay kinins in terms of their property of delaying the breakdown of protein in excised leaves through their effect upon RNA status. This property, which is usually manifested without accompanying cell division, was used by J. E. Loeffler and J. van Overbeek (Shell Development Company) as an assay for kinins in coconut endosperm. Evidence for three active compounds was obtained. The activity of coconut milk to tissue of the Jerusalem artichoke was found by A. Kovoor (University of Paris) to be due to its content of auxin and purines.

The characterization of native kinin should occur soon, since ways leading to the isolation of at least a derivative are clear. If, as seems likely, native kinin is a close relative of kinetin, the properties of kinetin should be a good guide to the properties of native kinin. Kinetin, for example, is required, together with auxin, for DNA replication, mitosis, and cytokinesis in dividing cells; it stimulates RNA synthesis in senescing tissues; and it interacts with auxin in regulating organ differentiation. The movement of kinetin within plant tissues is restricted, suggesting that the native kinin may be synthesized by the cells requiring it. Kinetin-like molecules are metabolized in plants along the normal pathways for purines. In whole plants, metabolites tend to move toward sites at which kinetin has been applied locally, and A. C. Leopold (Purdue) has made use of this tendency to create "sinks," at will, for metabolites for the study of leaf senescence. His observations, such as the observation that creation of a "sink" in the oldest leaf of a bean plant brings about senescence in younger leaves, support the concept that senescence is a correlative phenomenon. Senescence, being reversible, differs from the other developmental processes discussed here and it may therefore represent a different mode of influence of regulators upon development. Auxins and gibberellins, as well as kinins, are known to affect senescence. Leopold considers the effect of kinetin upon senescence to be due to an induced stimulation of mass flow of nutrient.

Inhibitors or Regulators

It is customary to label certain growth regulators as inhibitors. This name arises from their property of inhibiting auxin-induced enlargement of cells in excised stem tissues. But this property usually has no particular relevance to their suggested function in the plant. They are sought out as regulators of positive developmental processes such as dormancy or abscission; thus use of the term *inhibitor*, with its negative connotations, seems inadvisable, and terms relevant to the proposed physiological functions would appear to be more appropriate. In addition, inhibition of a complex process is too unspecific to be a reliable criterion for a regulator.

Dormancy regulators should be capable of inducing dormancy, and so far the only demonstrated case of this is in birch. P. F. Wareing (University College of Aberystwyth) has studied a substance which increases in birch leaves under dormancy-inducing, short-day conditions and when applied to leaves on twigs maintained under long-day conditions, induces dormancy of the buds. The substance has been iso-

lated from *Acer pseudoplatanus*, but in quantities too small for conclusive identification. Its spectral properties suggest an aliphatic or alicyclic substance, possibly a beta-hydroxy acid. There is no evidence of phenolic or other aromatic structure. Substances of apparently similar structure have been isolated from *Lupinus luteus* by K. Rothwell and R. L. Wain (Wye College), and from cotton fruits by F. T. Addicott and his co-workers (University of California); both substances are considered to be regulators of flower or fruit abscission. For substances with the same or similar structure to regulate processes as different as dormancy and abscission would appear to require that these regulators depend for their specific effects on the other classes of regulators present in the system. In this, of course, these substances are not unique. The workers mentioned have shown interactions between the substances they have isolated and added gibberellin, kinetin, or auxin.

Unclassified Regulators

There are a number of regulators which do not fit into any of these classes, and prominent among them, of course, are regulators of reproduction. Classically this is the province of florigen—the specific flower-forming substance. In general, however, the concept of specific organ-forming substances is no longer favored, and the concept of florigen has been of little help in investigations of the regulation of flowering, which, as is well known, results from a complex of partial processes. It is preferable to study the regulation of each of these processes, and it now appears that situations occur in which different partial processes limit flowering, and in which treatment with gibberellin, auxin, or kinin, depending on the situation, may cause flowers to form. But the evidence is against any of the above three regulators being the means by which the photoperiodically induced stimulus moves from the receptive leaves to the reaction center in the apex. Substances with this function have yet to be definitely located. D. L. Mayfield (Phytotron, Gif-sur-Yvette) has confirmed the earlier finding that extracts of *Xanthium* plants in which flowering had been photoinduced induce flowering in *Xanthium* plants held under noninductive, long-day conditions, whereas extracts of plants in which flowering had not been induced

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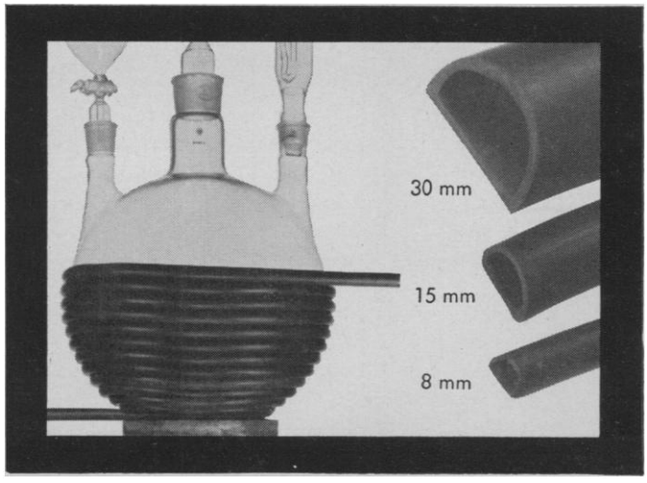

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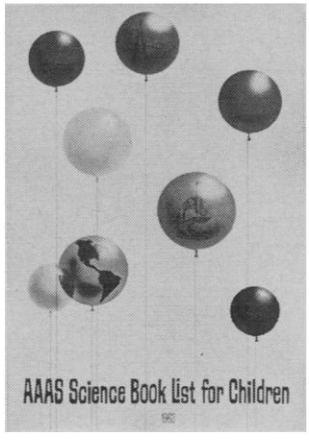

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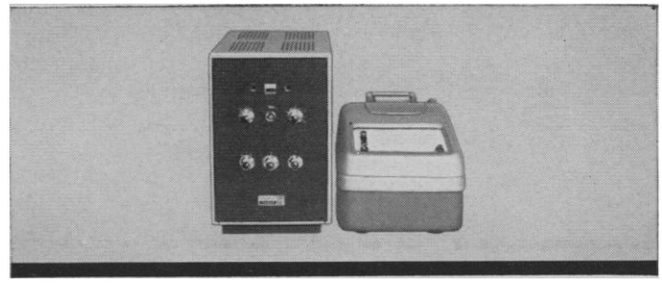

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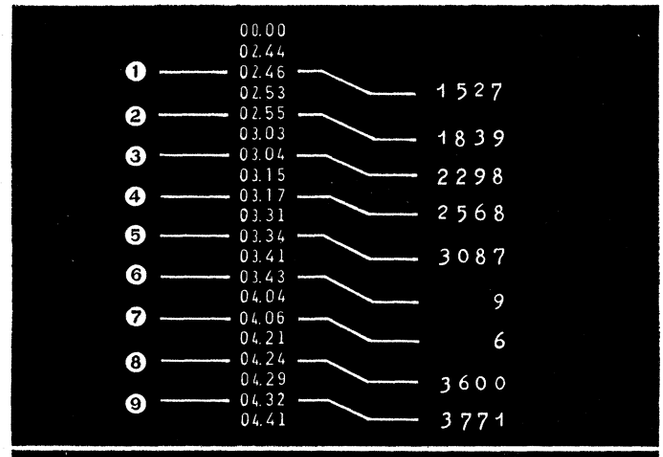

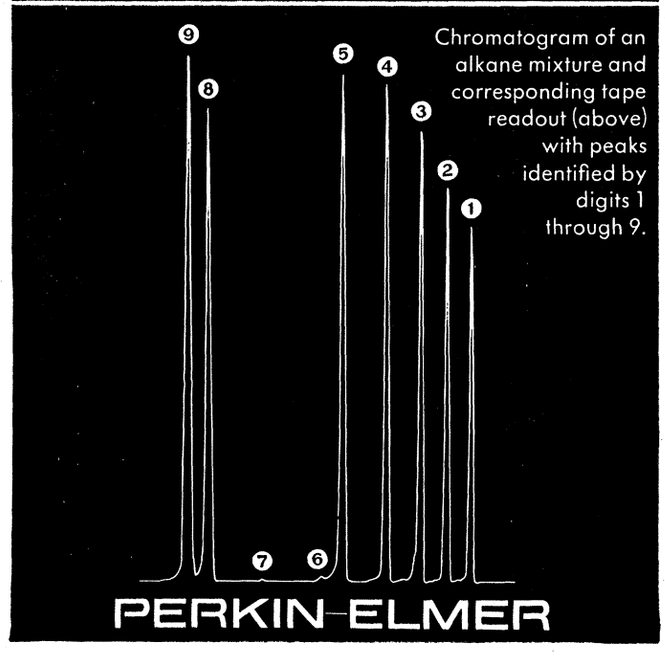

Chromatogram of an alkane mixture and corresponding tape readout (above) with peaks identified by digits 1 through 9.

do not have this effect. The active factor is water-soluble and acidic. A carboxylic acid of low molecular weight has been found by B. R. Voeller (Rockefeller Institute) to be the factor produced by fern gametophytes and to be active in inducing antheridia. A factor which has the same effect as vernalization of seeds has been isolated by T. Tomita (Tohoku University) from extracts of vernalized winter rye or radish. This factor and uridylic acid have very similar chemical properties, and both hasten the flowering of unvernalized plants, particularly in the presence of auxin.

A number of substances with characteristics of oxygenated terpenoids, which are cofactors with IAA in inducing root initiation on stem cuttings, have been found by C. E. Hess (Purdue) to occur in greater amounts in cuttings which readily form roots than in cuttings which root only with difficulty. Also among the as yet uncategorized regulators one may place the gibberellin-like substance extracted by Harada from hollyhock, the auxin-containing peptide found by Street in root-culture medium, and the lipid-like substance found by R. H. Roberts (University of Wisconsin) to quantitatively affect the growth of flowers.

It should not be inferred that the regulators which have not been fitted into a category represent the dregs of our experimental effort. On the contrary, they may represent a phase of growth regulation about which little is yet known. But it is unlikely that they act in isolation; rather, their effects probably result from interactions with other regulators. One substance which has the properties of a regulator and which interacts intimately and intricately with other regulators is ethylene. Its association with auxin is well known and, at the conference, was further documented by W. C. Hall and P. W. Morgan (Texas A & M), but an association with other regulators cannot be excluded. Auxin treatment may enhance ethylene synthesis, and ethylene treatment may enhance or inhibit auxin destruction, depending on the circumstances. An auxin-ethylene interaction can be demonstrated to regulate abscission, and S. P. Burg (University of Miami) has proved the general role of ethylene in regulating fruit ripening and flower fading. In mango fruits, however, the effect of ethylene may be counteracted, while the fruits are on the tree, by an inhibitor of ripening from the parent plant.

At this point we might ask whether all types of plant-growth regulators have been detected. It is not yet possible to answer this question. The classes of regulators already known are capable of producing a wide variety of developmental phenomena, but there may be other regulators still to be discovered. That some classes of chemicals may have been systematically excluded from consideration as regulators by the methods of extraction usually employed was suggested by J. Guern (University of Paris).

Analysis of Development

The structures of a number of classes of compounds which have been proposed as regulators of plant development have been described accurately or tentatively. The impression that plant development is the result of a developing pattern of interacting fields of these regulators has been built up. But this impression is far from ready to be put to the test. The design of such tests probably depends as much upon advances in the analysis of development, down to the molecular mechanisms for the inter- and intracellular regulation of metabolism, as on definition of the primary reaction sites of the regulators in the cell. At the conference, the analysis of development at a variety of levels was discussed. In an analysis of the contributions of cell enlargement and cell division to the growth, form, and maturation of organs and of their reactions to regulators or environmental stimuli, A. H. Haber and D. E. Foard (Oak Ridge National Laboratory) have demonstrated that the dominant process may be cell enlargement, quite independent of the occurrence or nonoccurrence of cell division, or of the total number of cells in a tissue. Within the process of cell division, D. Mazia (University of California) recognizes two levels of control, thus differentiating between the induction and the maintenance of cell division. The former is considered to be regulated by the induction of a cluster of enzymes, including DNA polymerase; the latter, by the state of the DNA. An analysis on yet another level has been made by J. Heslop-Harrison (University of Birmingham). He has been concerned with the mechanisms of events in development which are sequential, and in particular he has studied the transition from the vegetative to the floral state in meristems.