efficient in stabilizing the reaction in acid media. A study of the buffer capacity of different slightly soluble phosphates[3] showed that $Mg_3(PO_4)_2 \cdot 22H_2O$ can be used for alkaline media. As a result of an x-ray study[4] of these phosphates it was possible to show how to prepare and use them. These experiments enabled me to develop four nutrient mixtures:[5] (1) acid, pH 4.9–5.5; (2) slightly acid, pH 5.5–6.8; (3) neutral, pH 6.9–7.3; (4) alkaline, pH 7.5–8.0.

It is unnecessary to give further details of the work, which has already been published in complete form. I take this opportunity to emphasize once more that the details of the technique of my culture methods (including the aeration of the media to provide the roots with oxygen, the preparation of the salts, etc.) are of fundamental importance. These are fully described in my papers.

In my next work I shall discuss my experiments concerning the rôle of Mn, Si, I, Zn, Al, B, Cu, Li, Na, As, Ni, Co, etc., in mixtures of stable pH value.

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A RICH SOURCE OF β-CAROTENE

THE difficulty in separating the different carotenes and the danger of oxidation with increased handling have emphasized the desirability of working, where possible, with a source having only one form present. Since many of the richer sources contain mixtures of the two forms, it may be of interest to those working with the carotenes to know that the Perfection pimiento is a rich source of β-carotene, apparently free of α-carotene.

It has been shown[1] that with antimony trichloride α-carotene shows an absorption band at 542 mμ and β-carotene shows an absorption band at 590 mμ.

Using this method and the method of Zechmeister and Cholnoky[2] for the quantitative determination of carotene, dried pimiento shells were found to contain from 200 to 665 mg of β-carotene per kilogram. The quality of the fresh material and the method of preparation have considerable influence on the amount of carotene present in the dried product.

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WHAT IS A LOCUST?

ONE of the outstanding difficulties in teaching elementary entomology is the confusion concerning the word "locust." The so-called seventeen-year locust is of course a cicada, belonging to a totally different order from the true locusts. No doubt all teachers of entomology stress this point, but in the "Handbook for Boys," issued by the Boy Scouts of America, of which it appears that 4,792,871 copies have been printed, there is (p. 483) a picture of a cicada, labelled "Locust," without any qualification. This appears in an article by Dr. L. O. Howard, but as the text does not refer to this insect I infer that the illustration was added by the editor. Thus the popular error is reinforced on apparently good authority. Every effort should be made to substitute the unobjectionable term "cicada."

T. D. A. COCKERELL
UNIVERSITY OF COLORADO

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

MINUTES OF THE EXECUTIVE COMMITTEE

THE executive committee of the association held its spring meeting in New York City on April 15. By courtesy of the chairman the sessions were held in the office of the Science Press, Grand Central Terminal.

The meeting was called to order at 10 A. M. by the chairman with the following members of the committee present: Cattell (*chairman*), Compton, Conklin, Curtiss, Fox, Livingston, Thorndike, Ward, Wilson, Woods. Dr. Hildebrand was unable to attend. Formal sessions were held morning and afternoon, and following the evening dinner discussion was continued until 10 P. M.

(1) The permanent secretary reported on the proposed project for aiding unemployed scientists through government funds for emergency relief. Under the reorganization of the C.W.A. relief funds are distributed to the states. While provision is made for research projects under state relief commissions, no place was found in government organization for a national project. A communication is to be sent out from the permanent secretary's office advising all correspondents concerning the present situation.

(2) In response to a request for approval of a special measure now before Congress to provide fellowships for unemployed scientists the permanent secretary was advised to call attention to the Science

[3] *Comptes rend. Acad. Sci. Paris*, 194: 1924–1927, 1932.
[4] "Phosphorsäure," Berlin, 3: 279–297, 1933.
[5] The term "nutrient mixture" has been found preferable to "nutrient solution." The reason for this choice is fully explained in the publication cited above.

[1] Karrer, Walker, Schopp and Morf, *Nature*, 132: 16, 1933.
[2] *Ann.*, 455: 70, 1927.

Advisory Board appointed by President Roosevelt as being the proper agency to pass upon proposals.

(3) The mimeographed semi-annual report of the permanent secretary embracing data on finances, membership and other activities was presented and discussed.

(4) The permanent secretary was authorized to order not less than 4,000 copies of the new Summarized Proceedings volume.

(5) It was voted to present to the council for discussion at Pittsburgh an amendment to the constitution to provide for increasing the membership dues from $5 per annum to $6 or more per annum. (An amendment to the constitution requires unanimous vote at a general session of the association or a majority vote at two consecutive *annual meetings*.)

(6) Since it seemed that immediate provision might need to be made for increasing current income, it was proposed that payments be temporarily fixed by the council and that statements of dues for 1935 be printed as follows:

Dues for 1935	$5
Emergency	1
	$6

Final action was deferred and the topic made a special order of business for the Berkeley meeting of the council.

(7) The method of balloting for president and section officers was approved as formulated on a form submitted. That form was substantially like the form used last year.

(8) The Fidelity bond covering the permanent secretary and the executive assistant was approved, and the auditor, W. J. Humphreys, was authorized to sign the accountability certificate.

(9) Election of fellows was approved as follows: Section F, 1; Section L, 1; Section N, 1; Section Q, 74; total, 77.

(10) The National Council of Teachers of Mathematics was invited to participate in the Pittsburgh meeting next December.

(11) The Society for Research on Meteorites was invited to participate in the Berkeley meeting.

(12) It was voted that the permanent secretary should arrange for a Maiben lecture for the Berkeley meeting.

(13) After reporting plans for the Pittsburgh meeting in December, 1934, the permanent secretary called attention to the evident crowding of the meeting, since many societies plan to hold sessions on Thursday, Friday and Saturday, leaving the last half of the meeting with few features. The local committee has plans for the entertainment of visiting scientists on Sunday, and this may remedy the situation.

(14) It was voted to contribute one half, and not to exceed $100, of the expenses of the Biological Smoker, generally scheduled for the winter meeting.

(15) The general secretary was authorized to correspond with the secretary of the American Society of Naturalists regarding the association's participation in the Biological Smoker and to make general arrangements for this event.

(16) It was voted to contribute one half, and not to exceed $100, of the expenses of a smoker to be arranged for engineers, physicists, geologists, chemists and mathematicians at the Pittsburgh meeting.

(17) Dr. Compton was asked to confer with the secretary of the Engineering Section (M), Dean V. Bush, regarding a smoker for engineers with physicists, geologists, chemists and mathematicians or others, at the winter meeting and to work out the general arrangements.

(18) It was voted to approve the Phi Beta Kappa lecture scheduled for the Pittsburgh meeting in accord with the plan of the secretary of that society and with plans of the Section on Social and Economic Sciences and the Section on Historical and Philological Sciences for their meetings.

(19) It was proposed that election of officers at Pittsburgh be made a special order of business for the council on Monday morning, December 31, 1934.

(20) The meeting now tentatively scheduled for Rochester, New York, in the summer of 1936 was definitely fixed for that place and date.

(21) The office of the permanent secretary was asked to make a study of available meeting facilities in Washington in connection with the meeting scheduled for December, 1936.

(22) The permanent secretary was authorized to publish promptly the dates of the Rochester and Washington meetings and to inform the secretaries of the councils of the social and economic science societies and of the learned societies of the exact dates selected.

(23) A communication from Dr. Duren J. H. Ward, Denver, extended an invitation to members of the executive committee to stop in Denver *en route* to the Berkeley meeting for the purpose of investigating the facilities for a meeting in that city, now tentatively set for the summer of 1937, and to learn more about the organization of the Far-Reaching Foundation. The executive committee expressed its deep regret that the invitation could not be accepted.

(24) A report from the committee on the place of science in education was accepted and ordered filed.

(25) It was voted that the chairman of the executive committee arrange for a statement expressing appreciation of the association for the participation of Dr. W. M. Davis (deceased) in the Boston meeting and in particular as the Maiben lecturer. Details concerning publication and use of the statement were entrusted to the chairman.

(26) A report previously presented at the Boston meeting was read from the committee on grants, making recommendations regarding the use of the association's funds for research. The executive committee adopted the recommendation that grants in aid of research should be continued as in the past.

(27) The following were elected members of the committee on grants to succeed those whose terms had been completed:

Arthur H. Compton (1937) (for Physics), *chairman;* University of Chicago.
C. C. Little (1937) (for Zoology), Jackson Memorial Laboratory.
Edward W. Berry (1936) (for Geology), Johns Hopkins University.
Walter R. Miles (1936) (for Psychology), Yale University.

(28) Upon recommendation of the committee on Grants, the executive committee voted the following grants to be paid out of available funds of the treasurer:

F. C. Brackett, 11 Woodbine Street, Chevy Chase, Md.	$ 500
B. M. Duggar, University of Wisconsin, Madison, Wis.	420
J. C. Stearns, University of Denver, Denver, Colo.	250
	$1,170

(29) The executive committee voted the following grants, to be paid out of available funds of the treasurer, with the specific stipulation that these payments carry no obligation for the future:

Mt. Desert Laboratory	$100
Concilium Bibliographicum	100
American Mathematical Society	100

(30) It was suggested that an index of members, arranged by cities and states, be added to the new volume of Summarized Proceedings. This matter was left to the discretion of the chairman and permanent secretary with power.

(31) Dr. Arthur H. Compton was appointed the representative of the association at the Aberdeen meeting of the British Association for the Advancement of Science.

(32) The permanent secretary reported on a meeting of the American Council on Education held in Washington last February and was authorized to act as the association's representative at future meetings of the council.

(33) Dr. A. F. Woods was appointed as representative of the Section on Agriculture (O) on the Board of the Union of American Biological Societies, to take the place of Roscoe W. Thatcher, deceased.

(34) Resolutions were presented from the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, dealing with the curtailment of the scientific work at the Bureau of Standards. After discussion, the following resolutions were adopted:

WHEREAS, The American Association for the Advancement of Science, comprising with affiliated American scientific societies a membership of a quarter of a million, exists because its members are convinced of the importance to America of the advancement of science and its useful applications in this country;

WHEREAS, The Bureau of Standards plays an essential and unique rôle in supplying American scientists with technical data and methods concerned with materials, measurements and standards which are essential to the progress of science and not otherwise available;

WHEREAS, This and other scientific bureaus of the Federal Government represent a great capital investment of money, work and scientifically trained men, as well as a prolific source of those elements essential to the national prosperity and welfare of the future;

WHEREAS, The permanent importance to this country of the continued work of the scientific bureaus maintained by the Federal Government is relatively far greater than is implied by the half of one per cent. of the Federal budget allotted to these scientific bureaus;

WHEREAS, The recent cuts in appropriation to these bureaus have crippled their work and disorganized their staffs so seriously as to impair their service and in large measure destroy that capital investment of money, work and men on which the future technical progress of the country depends; and

WHEREAS, A large part of the budgetary savings effected by these curtailments are false economies in that: (1) the investment in some earlier work is lost; (2) some essential work is continued in a less efficient manner; (3) many former members of staffs of these bureaus are now maintained at government expense on emergency Federal projects of far less value and with far lower efficiency than that of the work from which they were dropped in the economy program; and (4) the technical effectiveness of the country is receiving a blow from which it will take years at best to recover; therefore be it

Resolved, That the attention of those responsible for the administration of Federal affairs be called to these unfortunate aspects of the present situation in the scientific bureaus of the Government, and that they be requested to provide adequately for the continuation of such scientific work as is, in the opinion of qualified scientists and technical experts, essential to the national prosperity and not capable of or appropriate for efficient continuation by non-governmental agencies; and be it further

Resolved, That copies of this resolution be sent to the President of the United States, to the members of his Cabinet, to the Director of the Budget and to members of Congress, and that it be published in the official organ of this association.

(35) A communication from Dr. J. C. Merriam regarding adult education was presented. After discussion a committee was appointed to consider the subject and to make a survey of possibilities for the A. A. A. S. to develop this work. The committee appointed is as follows: Harlow Shapley, *chairman*, W. H. Howell, C. C. Little, John C. Merriam and Wm. F. Ogburn. It was suggested that this committee consider the manner of cooperating with other organizations and co-opt other members or if desired form subcommittees to study special topics in order to report in October.

HENRY B. WARD,
Permanent Secretary

THE NATIONAL ACADEMY OF SCIENCES. IV

The velocity-distance relation for isolated extra-galactic nebulae: EDWIN HUBBLE and MILTON L. HUMASON. The velocity-distance relation, log $v = 0.2m + 0.706$, derived from 85 isolated nebulae, parallels that derived from clusters, but is displaced toward the brighter side by about one magnitude. The displacement is interpreted as an effect of selecting the nebulae on the basis of apparent magnitude. Since the luminosity function approximates a normal error curve with a maximum at M_o and the density function is constant, the frequency distribution of M for a given m will be another normal error curve with the same dispersion but with the maximum displaced by $M_o - \overline{M} = 1.386^2$. The observed displacement represents a dispersion of the order of 0.85 mag., in close agreement with observed dispersion, 0.86 mag., of the residuals. Isolated nebulae and cluster members give the same velocity-distance relation and hence are strictly comparable objects. M_o may be estimated from the Virgo cluster, where stars are found in some of the nebulae. The data as yet indicate no significant revision of the value previously derived, $M_o = -13.8$.

Loudness and pitch of musical tones and their relation to the intensity and frequency: H. FLETCHER (introduced by F. B. Jewett). Loudness and pitch are psychological terms which are used to describe sensations produced when certain types of waves operate upon the hearing mechanism. Intensity and frequency are the corresponding terms to describe the physical quantities power transferred per unit area and vibrations per second executed by the sound wave. The relation between these psychological and physical aspects of a musical tone has been investigated using a group of typical listeners. Precise scales were invented and used for representing the sensations of loudness and pitch. In comparing loudness a pure tone having a frequency of 1,000 cycles per second and with intensity variable throughout the audible range was used as a reference tone. In comparing pitch, a pure tone having a constant loudness and with frequency variable throughout the audible range was used as a reference tone. Typical results follow: A 50-cycle tone with an intensity which is 10,000 times that at the threshold of hearing produces the same loudness as a 1,000 cycle tone with an intensity which is 1,000,000,000 times its threshold value. The intensity of a complex tone with ten components all equal in intensity but different in frequency is ten times that of each component, as is well known. On the other hand, the loudness of one such complex tone with frequencies which are harmonics of 500 cycles per second was found to be equal to that of the 1,000 cycle component raised one thousand times rather than ten times in intensity. An observer's location of the pitch was found to depend upon the intensity as well as the frequency. For example, the pitch of a 200-cycle tone was located at a position which was as much as one quarter of an octave lower at the very high intensities than at the low intensities. For pure tones having frequencies near 2,000 or 3,000 cycles per second, no difference of pitch was observed as the intensity was changed. Similar small pitch changes were observed with complex tones. Some very large changes were observed with particular changes in the components. For example, the pitch of a complex tone having four components of equal intensity, but with frequencies of 400, 600, 800 and 1,000 cycles per second was perceived as that corresponding to a 200-cycle tone. If to this complex tone, three additional components having frequencies 500, 700 and 900 cycles per second, are added, then the pitch will be perceived as an octave lower or that corresponding to a 100-cycle tone.

The realm of the nebulae: EDWIN HUBBLE. The observable region—the region of space that can be explored with existing telescopes—is a vast sphere through which a hundred million nebulae are scattered at average intervals of the order of a million light years. Each nebula is a stellar system comparable with our own system of the Milky Way. If the observable region is a fair sample, we may hope to infer the nature of the universe from the observed characteristics of the sample. Two general characteristics have been established in the past five years. The large scale distribution of nebulae is uniform, since counts of nebulae behave as random samples of a homogeneous population. Light from the nebulae is reddened in direct proportion to the distance it has traveled. These data, together with the general laws of nature, permit certain inferences concerning the universe which are embodied in the current theories of cosmology.

African rift valleys: BAILEY WILLIS. African rift valleys have been interpreted as cracks due to tension produced by collapse of the hypothetical Gondwana Continent. They are found to be effects of unequal elevation, combined with local compression with or without extrusion of lavas. Theoretical discussion involves problems of general application to elevation subsidence and mountain building.

Isostasy and the eruptive crust: BAILEY WILLIS. Isostasy and eruptive crust are related as effect and cause. The argument is that the existing crust of the