perature at which some members of the genus Phormidium live normally. This altitude would not be much higher than the present plateau of Yellowstone Park. The fact that amino acids and a great many substances found in living organisms can be synthesized without the intervention of organisms by the ultra-violet radiations existing at such altitudes is suggestive of the probable place of origin of life forms. If such complex substances should be formed under present conditions, they would be quickly used by the omnipresent organisms capable of using them. Before the appearance of any living organism there would be possible the accumulation of such substances in quantity, a condition which is not realized under existing conditions. The action of hydrolytic enzymes in thermal algae might be substituted by the purely physical condition of high temperature on account of the increase in the rate of chemical reactions with increase in temperature according to the Van't Hoff coefficient. If high temperature can substitute the action of hydrolytic or other enzymes in these thermal algae, this may give a clue regarding the environmental conditions obtaining at the time of the origin of living things, since at high temperatures no such enzymes might be required. It is difficult to conceive of an organism originating with a full complement of enzymes, photosynthetic pigments, etc. Absence of certain important enzymes from an organism may well indicate a primitive type of physiological processes in which the organism makes use of physical conditions of the environment to substitute the action of complex biological catalysts. Since these thermal algae are able to carry on their life processes without catalase, which is found in all other organisms, and since they possess certain thermostable catalysts, with the additional use of high temperature to speed up other chemical reactions which are commonly catalyzed in other organisms by special enzymes, they seem particularly adapted to growth at high temperatures. Certain of the enzymes may have become necessary only in the evolution of forms adapted to lower temperature. The chemosynthetic forms of the iron and sulfur bacteria have been considered for several reasons to closely approach the type of physiological processes demanded for a primitive organism. They are able to fix atmospheric nitrogen, and they synthesize their carbon compounds without the intervention of photocatalytic pigments using the oxidation of inorganic material such as H_2S as the source of energy for synthesis.

The algae of these springs offer opportunity for the solution of some physiological questions of fundamental importance. Owing to the lack of facilities for laboratory work in Yellowstone Park at the time, determinations of other enzymes was delayed until they might be made upon material preserved with toluol and with 85 per cent. ethyl alcohol. Report upon the occurrence of other enzymes in these algae will be made by Miss Olga Lakela, who has completed the work.

R. B. Harvey

University of Minnesota

THE PRODUCTION OF HYDROGEN SULFIDE BY YEAST

The production of hydrogen sulfide by living yeast cells in the presence of sulfur or certain sulfur derivatives is well known in the literature. The work of de Rey-Pailhade[1] showed that yeast extracts were also able to produce hydrogen sulfide in the presence of sulfur. He attributed the formation of hydrogen sulfide to the presence of a substance in the yeast which he termed "philothion." The recent work of Hopkins,[2] however, appears to indicate that de Rey-Pailhade's "philothion" is similar to a dipeptide of glutamic acid and cystein which Hopkins isolated from yeast and animal cells. This compound after oxidation is easily reduced and also forms hydrogen sulfide when shaken with sulfur.

The presence of an active reducing enzyme in yeast has been demonstrated by Hahn[3] and others, so that very probably the reducing properties of yeast are largely due to enzyme activity of this nature.

The production of hydrogen sulfide by yeast, apart from its purely biochemical interest, is of considerable practical importance. Examples of hydrogen sulfide production are well known in the fermentation industries. Wine and beer stored in casks which have been fumigated with sulfur will often develop hydrogen sulfide, and such effects have been explained by the reducing activity of yeast in the presence of free sulfur, sulfites, and loosely bound sulfur compounds of a protein nature.

In flour and baking, however, the production of hydrogen sulfide by yeast in dough seems to have received little or no attention, and the writer has been unable to find any information or reference to this phenomenon in the literature thus far examined.

Recently the production of hydrogen sulfide by yeast in this connection was brought to the writer's attention. The flour was a northern spring patent, of normal appearance, odor and taste. It was capable of producing a fairly good bread, but on fermentation gave off the odor of hydrogen sulfide. An

1 Rey-Pailhade, J. de *Compt. rend.*, *106*, 1683, *107*, 43, 1888, and subsequently.

2 Hopkins, F. G., *Bio-chem. J.*, *15*, 286–315, 1921.

3 Hahn, M., Münchener med. Wochenschrift, S. 595, 1902.

examination of the flour by the writer showed that when it was mixed in a dough with water and the usual amounts of the ingredients of a dough batch, hydrogen sulfide was evolved in quantities sufficient to discolor lead acetate paper immediately, followed by complete blackening, in less than a minute. Doughs made with 50 grams of flour, sufficient water and 1 gram of compressed baker's yeast also evolved hydrogen sulfide.

A dough was made of the flour with water containing hydrochloric acid; this was warmed and the atmosphere above the suspension tested for hydrogen sulfide. The test was negative.

Hydrogen sulfide could be obtained from the flour by the addition of sulfur free zinc and hydrochloric acid. This reaction has not yet been observed with other flours which we have examined in this connection.

We have not yet determined the identity of the sulfur compound present in this flour which is reduced by the living yeast cells, but there is a possibility that the formation of hydrogen sulfide is due to the presence of sulfur or its derivatives absorbed by the flour from the fumigation of a storage warehouse with burning sulfur.

The problem is still under investigation and the writer would appreciate any information or suggestions from those who find this note a matter of interest.

C. B. MORISON

AMERICAN INSTITUTE OF BAKING,
CHICAGO, ILLINOIS

NINTH ANNUAL MEETING OF THE OPTICAL SOCIETY OF AMERICA

THE Optical Society of America met in Boston from October 23 to 25 for its ninth annual meeting. Three sessions were held at the Massachusetts Institute of Technology, two at Harvard College and one at the Boston Museum of Art.

Among the special features were addresses by Professor Ch. Fabry, of the University of Paris, on "The measurement of light"; Dr. E. R. Berry and Dr. Elihu Thomson, of the General Electric Company, on "The development of clear fused quartz"; Dr. Paul Heymens, of the Massachusetts Institute of Technology, on "Photoelasticity"; Dr. H. E. Ives, of the Western Electric Company, on "The transmission of photographs over telephone lines"; and Dr. Benjamin Ives Gilman, of the Boston Museum of Art, on "Modern solution of the problem of gallery lighting."

The following papers comprised the contributed program:

PHOTOCHEMISTRY, PHOTOGRAPHY AND GEOMETRICAL OPTICS

Report of the committee on photochemistry and photography: S. E. SHEPPARD.

On the relation between time and intensity in photographic exposure: L. A. JONES and EMERY HUSE.

A new non-intermittent sensitometer: ARTHUR C. HARDY.

Report of the committee on geometrical optics: A. E. WRIGHT.

A new instrument for the objective determination of the refraction of the eye: HERMANN KELLNER.

The chromatic aberration of fused bifocal spectacle lenses: W. B. RAYTON.

Image curvature as a function of diaphragm position: I. C. GARDNER and J. J. ARNAUD.

An instrument for the laboratory testing of binocular telescopes: G. W. MOFFITT and PAUL B. TAYLOR.

A direct system of design for the cemented two lens telescope objective: G. W. MOFFITT.

PHYSICAL OPTICS

Report of the committee on physical optics: L. R. INGERSOLL.

An analysis of the arc and spark spectra of chromium: C. C. KIESS.

Visible radiation from solid targets: PAUL D. FOOTE, W. F. MEGGERS and R. L. CHENAULT.

An improved type of illuminator for use in metallographic microscopy: LEWIS E. JEWELL.

The effect of variation of applied voltage, current and power on the candle-power and the spectral energy distribution of incandescent electric lamps: C. MATSUDA.

RADIATION AND PHOTOMETRY

Report of the committee on radiometry and photometry: E. C. CRITTENDEN.

A null method photoelectric photometer: L. BEHR.

Note on the least mechanical equivalent of light: HERBERT E. IVES.

A new method for spectrophotometry: L. A. JONES.

A direct reading spectrophotometer: CARL W. KEUFFEL.

The use of the D'Arsonval galvanometer in radiation measurements: EDISON PETTIT.

New measurements of planetary radiation: W. W. COBLENTZ and C. O. LAMPLAND.

COLOR AND COLOR TERMINOLOGY

An appendix to the English translation of the "Physiological Optics" of Helmholtz: DR. CHRISTINE LADD-FRANKLIN.

Report of the committee on color terminology: CHARLES BITTINGER.

The specification of color in terms of dominant wavelength, purity and brightness: IRWIN G. PRIEST, K. S. GIBSON and A. E. O. MUNSELL.

Spectral centroid relations for artificial daylight filters: K. S. GIBSON.