mathematician. This is rather a comment on the existing dissemination of information about the Stieltjes integral rather than on the authors' choice of material. For there has been an evident effort in this work to meet the student of applied mathematics on his own ground.

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SOCIETIES AND MEETINGS

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS

HEREWITH is presented the eleventh annual report of the Pickering Memorial astronomer and the recorder of the American Association of Variable Star Observers. The past year, during most of which our own country has been involved in war, has, in spite of difficulties incidental to such conditions, been productive of results in the field of variable star observations and the studies of the variables themselves. With the decrease in time occupied in the routine care of the somewhat smaller number of observations which have been communicated, the recorder has been able to devote considerably more time to the long-planned statistical study of the variables—principally those of long period—which have for more than three decades been on the observing list of the association.

Not only have the reports from foreign observers been necessarily fewer and smaller, but our own observers have been fewer in number, as some of them have either joined the armed forces or have been engaged in other wartime activities.

Among those who are known to be actively participating in the armed services are Ensign C. B. Ford, formerly of Smith College; Private J. Russell Smith, formerly of Lubbock, Texas, and Captain A. T. Murphy, formerly of San Francisco, California. Foster D. Brunton, of Guam, is a prisoner of war, as is doubtless Father Depperman, in Manila.

The library continues to be used to some extent. Acquisitions during the past year numbered 168, including 43 volumes and parts of volumes, besides numerous reprints. Gifts of eleven books have been made by H. B. Webb, Anton Kovar, E. H. Jones and the recorder.

Slides: Again attention is called to the excellent collection of slides which is available for loan to members. It could be used much more extensively.

Telescopes: The three-inch telescope formerly owned by the late Sigmund K. Proctor has been donated by his mother, Mrs. Helene F. Proctor, as a memorial, and is now on loan to Mrs. Federer.

Publications: The *Bi-Monthly Bulletin* continues to serve a useful purpose. Three numbers of *Variable Comments* have been issued: one deals with the 1941 fall meeting, the report written by C. B. Ford; another contains the tenth annual report of the recorder; and the third covers the A.A.V.S.O. Get-together at New Haven in June, 1942, by Helen S. Federer.

"Variable Star Notes" appear regularly in *Popular Astronomy* and as a Harvard reprint at the end of the year. The original observations appear in the Harvard *Annals,* and Nos. 2, 3 and 4 of Volume 110 have been issued. Instead of containing the observations for each quarter separately, individual numbers now cover six months or more of observations.

Side Activities: It is to be regretted that activities other than the regular variable star observing program have not received the attention which was given them in former years. Doubtless the war can be blamed for much of the seeming neglect of these phases of our work. The Nova search has dropped considerably and the photographic research has been practically nil. The work of the occultations committee will be detailed by the chairman of that committee.

Professor Bobrovnikoff, of Perkins Observatory, Delaware, Ohio, hopes that members of the association will cooperate with him in the estimations of the brightness of comets. He has shown that some valuable cooperative work could be done by trained variable star observers. He is willing to give advice in this field of observing to all inquirers.

Research Problems: The hope expressed by the recorder in his tenth report, that he would be able to start on a real campaign of the discussion of the long-period variables, has been fully realized. During the past ten months he has discussed 250 variables. This has involved the handling of approximately 450,000 observations covering, in general, the past twenty years. The discussion has included not only new derivations of the mean light curves, but also the final determination of dates of maximum and minimum—about 12,500 dates—as well as the accumulation of an abundance of material for studying numerous correlations which pertain for the variables, especially the Me stars.

Results on a hundred of the variables have appeared in instalments of twenty-five each in *Variable Star Notes* for this year, together with diagrams of the light curves.

The SS Cygni and R Coronae Borealis stars have been well observed. SU Tauri dropped to a deep minimum, and RY Sagittarii to a shallow minimum, according to recent reports.

Annual Summary: Again, we must record a falling off in the number of observations received during the year, a total of 33,090 observations as against 37,443 for last year. Observations are meager for a few stars, especially the southern ones, but on the whole,

despite the smaller number of observations, the continuity of the light curves has been well maintained.

Cyrus F. Fernald, of Wilton, Maine, again heads the list, with a total of 4,206 observations. He observed on 143 nights, and reports having spent 207 actual hours at observing, an average of twenty stars per hour. This is a remarkable record, and well attests the value of having a finely mounted and properly adjusted telescope—an 8-inch Springfield reflector—combined with considerable experience and plenty of enthusiasm. How much time Mr. Fernald spends in listing his reports would be of interest.

In the 2,100 to 2,300 class are Holt, of Tucson, Ariz.; deKock, of South Africa; Cilley, of Lewisburg, W. Va.; and Peltier, of Delphos, Ohio. In the 1,100 to 1,800 class are Mrs. Kearons, and Messrs. Hartmann, Jones and Chandra.

Nine observers made between 500 and 1,000 estimates each, and eleven, between 200 and 500. These twenty-nine observers made 87 per cent. of all the observations, but the other 61 contributors, 13 per cent., have added materially to the cause.

Special mention should be made of the interest shown by our Canadian observers. We now have five active contributors from that country, with a total of 914 observations for the year. Our South African observers contributed 4,179 observations; from India came 1,602, and from Mexico, 952. Australia, Argentina and Japan contributed 372, 96 and 87, respectively. Our 74 American observers accumulated a total of 24,888 observations.

The eleven observers of the Milwaukee Astronomical Society contributed 1,518 observations; the three from the Fall River, Mass., group, 2,630; and the three in Portland, Maine, 431.

Personnel: Mrs. Helen S. Federer has acted as Pickering Memorial assistant throughout the year. She has acted as custodian of the records, plotting the observations and picking up discrepancies when they occurred. She has also looked after the correspondence and mailing out of *Bulletins, Annals* and so forth, thus allowing the recorder to spend much of his time on the discussion of the variables.

When the million mark will be attained is still a question, but to date the American Association of Variable Star Observers has reached a grand total of 880,000 observations in the 31 years since it began its work. We must not permit the variables to go unobserved, even in these war-torn times; an ever-continuing history of the activities of our variables must be maintained, in so far as it is possible. But first and foremost must come the winning of this war, and the sooner the better for civilization and for science.

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SPECIAL ARTICLES

PIMELIC ACID, BIOTIN AND CERTAIN FUNGI

EVIDENCE that pimelic acid is utilized by the diphtheria bacillus for the synthesis of biotin has been presented by du Vigneaud, Dittmer, Hague and Long.[1] Eakin and Eakin[2] report that the synthesis of biotin by *Aspergillus niger* was increased by the addition to the medium of pimelic acid, and the effect was enhanced by cysteine or cystine. However, du Vigneaud and associates found that pimelic acid did not replace biotin in its growth-stimulating effect on yeast. We have attempted without success to replace biotin with pimelic acid for thirteen fungi which suffer from a biotin deficiency.

The following organisms were used in one series of experiments: *Ceratostomella ips* #255, *C. ips* #438, *C. microspora, C. montium, C. obscura, C. penicillata, C. pini, C. radicicola, Grosmannia serpens, Fusarium avenaceum, Neurospora sitophila* 56.2 and *N. tetraspora* S_1. None of these fungi makes more than slight growth on a mineral-dextrose medium containing asparagine and purified agar unless biotin is present. The addition of 0.05 μ g of biotin to a tube containing 8 ml of the basal medium permits luxuriant growth.[3]

Negative results were obtained when the 0.05 μ g of biotin was replaced with 0.05 μ g of pimelic acid. No benefit was observed when the quantity of pimelic acid was increased to 0.1 μ g per tube containing 8 ml of medium.

Sulfur is furnished in our basal medium as $MgSO_4$. The medium used for the cultivation of the diphtheria bacillus contained *l*-cystine. Eakin and Eakin found that cysteine or cystine markedly increased the formation of biotin by *Aspergillus niger* in the presence of pimelic acid. However, none of the twelve fungi listed above grew when 0.1 μ g of pimelic acid and 1 mg of *l*-cystine, 0.1 μ g of pimelic acid and 1 mg of glutathione or 0.1 μ g of pimelic acid and 1 mg of methionine were added to the basal medium instead of biotin. Excellent growth was obtained when the pimelic acid in the above media was replaced by

[1] Vincent du Vigneaud, Karl Dittmer, Eleanor Hague and Barbara Long, SCIENCE, 96: 186, 187, 1942.

[2] Robert E. Eakin and Esther A. Eakin, SCIENCE, 96: 187, 188, 1942.

[3] Some of these fungi must be supplied also with thiamine or pyridoxine or with both vitamins in addition to biotin.