

THE PHYCOLOGICAL SOCIETY OF AMERICA

'Ipse super maria fundavit eum.' Psalms.

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P. C. SILVA, Editor

THE STANFORD MEETINGS

The twelfth annual meeting of the Phycological Society of America was held in conjunction with the A. I. B. S. convention at Stanford University, August 25 to 29, 1957. Early Monday morning, August 26, a seaweed excursion was held at Moss Beach, San Mateo County, California. On Wednesday morning Dr. G. F. Papenfuss presided over a symposium on "Recent Advances in Phycology," in which Drs. P. C. Silva, C. C. Davis, F. T. Haxo, and R. C. Starr participated. Individual papers were presented at sessions Tuesday morning and afternoon. All sessions were held jointly with the Phycological Section of the Botanical Society of America.

MINUTES OF THE BUSINESS MEETING

The business meeting of the Phycological Society of America was called to order by the President, Dr. G. F. Papenfuss, at 4:15 p. m., August 27, in Room 264, Outer Quadrangle, with 18 members present.

Minutes of the eleventh annual meeting (Storrs, Connecticut) were approved as circulated to members in News Bulletin No. 28.

OLD BUSINESS

Committee on Revision of Constitution and By-Laws

A revised draft of the Constitution and By-Laws was prepared by a committee (H. C. Bold, P. C. Silva, and W. R. Taylor, chairman) and submitted to the membership in June 1957. It was adopted by a mail vote of 89 to 3. The principal changes are the elimination of the provision for Fellows, the establishment of the position of Editor, and the merger of the offices of Secretary and Treasurer.

Secretary's Report

The following officers were elected by mail ballot from a slate of nominees prepared by the Nominating Committee (F. T. Haxo, L. H. Tiffany, and H. C. Bold, chairman):

L. A. Whitford, North Carolina State College	President
P. C. Silva, University of Illinois	Vice-President
W. A. Daily, Butler University	Secretary
R. C. Starr, Indiana University	Treasurer

During the past year the membership showed a net gain of 16 and now stands at 275. A gain of 24 new members was counteracted in part by one death (Professor John H. Hoskins), two resignations, and five members dropped for non-payment of dues.

Treasurer's Report

Balance on hand, Aug. 28, 1956		\$1,547.52
Income		
Dues	\$ 492.07	
Sale of reprints and back issues	121.74	
Interest on savings	9.90	
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	\$ 623.71	
Expenditures		
Printing and mailing of <i>News Bulletin</i>	\$1,066.28	
Secretary's expenses	29.55	
Treasurer's expenses	0.15	
Bank charges	4.72	
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	\$1,100.70	
Net loss		476.99
		<hr/>
Balance on hand, Aug. 21, 1957		\$1,070.53
Assets		
Checking account, Farmers Bank, Union Point, Georgia	\$ 333.00	
Savings account, Farmers Bank	737.53	
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		\$1,070.53

NEW BUSINESS

Executive Committee's Report

The thirteenth annual meeting of the Society will be held in conjunction with the A. I. B. S. convention at Indiana University, Bloomington, August 24-28, 1958.

The Secretary was instructed to write a letter of appreciation to Professor G. M. Smith, our distinguished local representative for the Stanford meetings.

Ninth International Botanical Congress

Excerpts were read from a letter addressed to U. S. botanists by the liaison officer, Dr. Pierre Dansereau, explaining the organization of the Congress. The program committee has established several subcommittees, including one for phycology, headed by Professor Jules Brunel. No special meetings of societies will be allowed to run concurrently with congress sectional meetings or to be jointly sponsored by them.

National Register of Scientific and Technical Personnel

Dr. Papenfuss urged increased cooperation from members of the Society in responding to requests for information for this register. Only 33% of U. S. members responded previously. United States members who have not yet completed the questionnaire and who may have discarded or misplaced it should request another form from Miss Joan V. Batterton, A. I. B. S. Register, 2000 P Street, N. W., Washington 6, D. C.

The meeting was adjourned.

Respectfully submitted,
P. C. SILVA,
Secretary

ABSTRACTS OF PAPERS PRESENTED AT STANFORD

**Uptake of Ammonium and Nitrate Nitrogen
by Various Species of Green Algae**

John F. Schuler and Violet M. Diller

University of Cincinnati

The assimilation of nitrogen by algae must be regarded as a very important aspect of metabolism because of the parallelism between growth and protein synthesis. Relatively little is known of the preference of different species of algae for nitrate or ammonium nitrogen. Incorporation into the medium of ammonium nitrate labeled with the stable isotope N^{15} and an analysis of the cells grown for the concentration of N^{15} , using a mass spectrometer, offers a direct method of determining relative assimilation of ammonium and nitrate nitrogen when both types are present in the medium. We present results obtained in this way for a large number of species of green algae and one xanthophycean form (*Pleurochloris*).

The cultures were grown in flasks containing liquid medium consisting of inorganic salts, sodium acetate, and glucose. The inoculated flasks were kept under controlled temperature and light conditions throughout the growth period. Data were obtained for 45 strains encompassing 12 genera and at least 21 different species.

Most of the strains tested retained more ammonium than nitrate nitrogen, in various degrees, evidently characteristic of the organism. These strains were from the following genera: *Chlamydomonas*, *Chlorogonium*, *Chlorella*, *Dactylococcus*, *Dictyococcus*, *Pleurochloris*, *Scenedesmus*, *Stichococcus*, and *Trebouxia*.

Hypnomonas lobata, *Prolosiphon botryoides*, and *Stichococcus subtilis* assimilated and retained ammonium and nitrate nitrogen in approximately equal proportions; it is clear this was due to the choice of the organism since in each case there was still an ample supply of ammonium nitrogen in the medium at the end of the experiment.

In the case of *Chlamydomonas humicola*, two strains of *Chlorella variegata*, *Muriella aurantiaca*, and one strain of *Trebouxia cladoniae*, the present

data are inconclusive. Their low atom % N^{15} could be explained by the fact that at the end of the growth period the ammonium nitrogen was depleted and the cells were forced to take nitrate nitrogen. However, this need not necessarily be the explanation, because an alga could assimilate both nitrate and ammonium nitrogen from the beginning of growth, in which case the ammonium concentration in the medium would be low and the atom % N^{15} in the cells would be low also.

Studies on the Nutrition of *Protothiphon botryoides*

Joseph C. O'Kelley and Walter R. Herndon

University of Alabama

Growth and development of *Protothiphon botryoides* (Kütz.) Klebs has been studied in inorganic nutrient media with and without added soil extract prepared from Alabama red clay soil. The alga appears to grow indefinitely on an inorganic medium. Vacuolation and sac formation regularly occurred in the inorganic nutrient solution about 10 days after transfer of the organism to fresh medium. In the same medium enriched with soil extract sacs failed to develop; the cells were uniformly small and without extensive vacuolation; zoospore formation and new cell production appeared to be favored over cell enlargement and sac formation. Ash prepared from the soil extract and added to the basal mineral solution along with enough ethylene diamine tetra-acetic acid to give a 0.01% solution produced a growth pattern indistinguishable from that obtained with the whole soil extract. Spectroscopic analysis of ash obtained from the soil extract indicated the presence of the following elements not included in the inorganic nutrient medium: silicon, aluminum, titanium, barium, chromium and lithium.

A study of the effects of certain trace elements on growth of the organism indicated the following concentration of trace element salts to be optimum for maximum growth as measured by total cell volume: H_3BO_3 , 5.7 mg/liter; $CuCl_2 \cdot H_2O$, less than 1.07 mg/liter; sequestrene- $NaFe$, 89.5 mg/liter; $MnCl_2 \cdot 4H_2O$, 0.72 mg/liter; $(NH_4)_6Mo_7O_{24} \cdot 4H_2O$, 36 mg/liter; $ZnCl_2$, 3.12 mg/liter. The process of sac formation appeared to be more sensitive to inhibition by copper than did over-all growth.

Sexuality in *Closterium moniliferum*

J. Eugene Fox

Indiana University

The conjugation of two desmids usually results in the formation of a single zygospore. Cases have been described, however, in which zygospores are produced in pairs. Little is known of the method of formation of such twin zygospores. As part of a larger study of sexual reproduction in the genus *Closterium*, certain observations have been made which have some bearing on this problem of single and double zygospores.

Sexual strains of *Closterium moniliferum* (Bory) Ehrenberg have been isolated from six localities. In strains from three of the localities conjugation occurs between recently divided, immature sister cells, indicating that they are homothallic. In the strains from three other localities conjugation occurs only when certain clones from each locality are mixed. In these heterothallic strains cells of the opposite mating type pair before conjugation. Each cell then divides and the opposite, immature cells conjugate; twin zygospores are thus formed.

Zygospores of all strains germinate to give two products. In the heterothallic strains the two products are of opposite mating type, while in the homothallic strains each zygote product is capable of giving rise to a homothallic clone.

Since in the strains studied the production of double zygospores is the result of heterothallism, and the production of single zygospores by sister cell conjugation is the characteristic result of homothallism, a correlation exists in *Closterium moniliferum* between the morphological aspects and the physiological aspects of sexual reproduction. Whether this explanation will suffice for similar situations in other species and genera of desmids is yet to be seen.

Algal Colonization in a Central Oklahoma Prairie

Herman S. Forest
University of Oklahoma

Progress on an incomplete study of soil algae has furnished information on the colonization of sterile soil. The pioneers at one month and the settlers at three months were species dominant in the undisturbed soil around the four-inch pot plots of sterilized soil returned to their original sites. The frequency and composition at three months showed succession toward the community present in the surrounding area. Algal crusts in the area differed from non-crusts areas chiefly in quantitative composition of dominants, although *Chlorococcum*, a ubiquitous dominant, is almost absent from surface layers.

Studies with the Diatom, *Phaeodactylum*

Joyce C. Lewin
Woods Hole Oceanographic Institution

Phaeodactylum tricorutum Bohlin has been isolated from a marine tank at Woods Hole, Mass. It appears to be identical with the Plymouth strain of "*Nitzschia closterium* forma *minutissima*". Cells were of two characteristic types, oval and fusiform, each of which remained constant for many cell divisions in clonal culture. Triradiate cells arose rarely as atypical forms of the fusiform variety. Oval cells could arise as endospores within a fusiform cell. The transition from oval to fusiform has also been studied, but details of the life cycle remain to be worked out.

Electron micrographs have shown the fusiform cells to be devoid of any organized siliceous structure, in agreement with previous observations. However, the oval cells were seen to possess a silicea valve of a pennate diatom type, resembling those of the genus *Cymbella*. Only one valve was present on each cell, the remainder of the cell wall being unsilicified. The valve was 6.2 μ long, was equipped with a raphe, and was perforated by pores arranged in 60 striae. Mucilaginous capsular material, soluble in hot water, represented 16% of the dry weight of oval cells; it was absent from fusiform cells. Acid hydrolysis and paper chromatography indicated xylose, mannose, fucose, and galactose as components of the capsule.

Fusiform cells of *Phaeodactylum* have in the past been confused with the true *Nitzschia closterium* (Ehrenberg) W. Sm. However, electronmicrographs of the siliceous frustules demonstrated conclusively that these are two wholly unrelated organisms.

Studies on *Astrephomene gubernaculifera* and *Volvulina steinii*

Janet R. Stein

University of California, Berkeley

Two of the less common members of the colonial Volvocales are the monotypic genera *Astrephomene* and *Volvulina*. Although they have been collected in such diverse places as South Africa, Australia and the United States, they have been rarely observed.

The basic construction of the coenobium is similar; however, slight differences exist. In both algae each biflagellate cell contains a single bowl-shaped chloroplast, many contractile vacuoles and is surrounded by a separate gelatinous membrane which does not coalesce with that of neighboring cells until late in daughter colony formation, if at all. There are no pyrenoids in vegetative cells.

Volvulina steinii Playfair is a 16-celled elliptically shaped coenobium in which all the cells are the same size. The cells are lenticular in shape as a result of their appression to the outer edge of the gelatinous matrix. Asexual reproduction is like that of other members of the Volvocaceae, with a modified type of inversion occurring.

Astrephomene gubernaculifera Picoek is a 16-, 32-, 64-, or 128-celled spherically shaped coenobium with a slightly flattened posterior end owing to the occurrence of several small cells whose apices are so oriented as to form a directive apparatus, or 'rudder'. Asexual reproduction in this genus is unique in that no inversion of the newly formed daughter colony occurs. After the first nuclear and cytoplasmic division, the apices of the two daughter cells are oriented outward and the plane of future divisions is such that the anterior end (the end destined to produce the flagella) of all cells is outward.

Cytological observations show that *Volvulina* contains 7 chromosomes whereas *Astrephomene* has 4, 6, 7, or 8 chromosomes. The 6- and 8-chromo-

some conditions appear to be derived from the more common 7-chromosome condition, probably as a result of non-disjunction and breakage of a nuclear chromosome. The origin of the 4-chromosome condition is as yet unexplained.

The details of sexual reproduction in *Astrephomene* and *Volvulina* are quite similar. Both organisms are heterothallic and isogamous. Upon mixing sexually mature colonies of opposite mating type, immediate clumping of the colonies occurs. The naked gametes escape from the coenobia and fuse, forming a planozygote that later becomes a smooth-walled zygospore. Shortly after conjugation two or more pyrenoids develop in the zygote.

Astrephomene and *Volvulina* require organic compounds in addition to the minerals necessary for growth of green plants. Preliminary work has shown that acetate as well as one of the B vitamins (possibly thiamin and/or *para*-aminobenzoic acid) is necessary to insure growth in a bacteria-free medium. It is interesting to note that a sexual strain of *Gonium pectorale* Müller isolated from the same source as *Astrephomene* and *Volvulina* requires only the addition of vitamin B₁₂ to the mineral medium.

Observations on the Life History of *Codiolum petrocelidis*

Kung-Chu Fan

University of California, Berkeley

Among the more interesting observations on the life histories of marine green algae are those that have shown that *Codiolum gregarium* Braun and *Urospora penicilliformis* (Roth) Aresch. are stages in the life history of the same alga. The object of the present investigation (which was suggested by Dr. G. F. Papenfuss) was to ascertain whether *Codiolum petrocelidis* Kueckuck agree with *C. gregarium* in being a stage in the life history of *Urospora*.

Codiolum petrocelidis and *Urospora* sp., collected at Moss Beach (south of San Francisco), are being cultured at the University of California. Filaments of *Urospora* sp. produce quadriflagellate zoospores which develop into *Urospora* plants again and again. The spores of *C. petrocelidis*, however, produce plants that are typical of *Spongomorpha coalita* (Rupr.) Collins. Dr. G. M. Smith (Iyengar Comm. Vol., Journ. Indian Bot. Soc., 1946, pp. 201-208) found that all plants of *Spongomorpha coalita* that he collected were gametophytic, diligent search for zoospores failing to reveal the presence of sporophytic plants. I have studied the sexual reproduction of *S. coalita*. The zygote develops into a large spherical cell with a long stalk.

Although many details still need to be studied, especially as regards cytology, it is safe to conclude that *S. coalita* and *C. petrocelidis* represent the gametophytic and sporophytic generations, respectively, in the life history of the same alga. The work is continuing and a detailed report will be published later. During the course of this investigation it was discovered that Dr. G. J. Hollenberg has also been studying the life history of *Spongomorpha coalita*.

Culture Studies of *Spongomorpha coalita*

George J. Hollenberg

University of Redlands

Zygotes were cultured during the summers of 1953-1956 inclusive. They grew slowly, remaining unicellular but developing each a single long contorted rhizoidal process, indicating that the alternate stage is probably some endophyte such as *Codiolum*. In the 1955 cultures several multicellular branching plants resembling *Spongomorpha* in cell detail developed from the unicellular germlings after about three months. These multicellular plants failed to survive long enough to show the hooked branchlets characteristic of *Spongomorpha*. Attempts to find and culture *Codiolum* were unsuccessful.

Observations Concerning the Sporophylls of *Egregia* Along the Coast of California

George J. Hollenberg

University of Redlands

Sporophylls of *Egregia laevigata* subsp. *borcalis* (Setchell) Silva from Stillwater Cove on the Monterey Peninsula are blade-like and the surface of the sorus is always smooth. Sporophylls of typical *E. laevigata* Setchell from Southern California are usually pod-like to nearly cylindrical, but are sometimes blade-like. The fruiting surface of the sporophylls of the latter plant are always corrugated, with sporangia arising in the depressions only. The sporophylls of *E. menziesii* (Turner) Aresch. are cuneate to spatulate as described by Setchell and Gardner. The surface is smooth and the sorus continuous. The sporophylls are considerably smaller than those of the other two plants.

Electron-micrographs of *Chlamydomonas*

Ralph A. Lewin and Sarah P. Gibbs

Marine Biological Laboratory, Woods Hole, Massachusetts

Thin sections of *Chlamydomonas moewusii* were prepared after the cells were fixed with osmium tetroxide and embedded in methacrylate resin. The flagella are seen in transverse sections to comprise nine double peripheral fibrils and a central pair, embedded in a structureless matrix by a defined membrane. In each cell, the basal bodies of the two flagella are joined end-to-end to form a single structural unit, of which the walls are continuous with the outer cylinder of flagellar fibrils. An anterior conical projection from the middle of this unit extends into the papilla.

In pairing, the gametes are attached by a dense fibrous bridge between the two anterior projections. This perforates the cell walls and establishes a pathway by which motility factors involved in flagellar activity may be transmitted (Lewin, R. A., J. Gen. Microbiol. 11: 358-363, 1954).