THE PHYCOLOGICAL SOCIETY OF AMERICA

'Ipse super maria fundavit eum.' Psalms.

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P. C. Silva, Editor and Secretary

THE STORRS MEETINGS

The eleventh annual meeting of the Phycological Society of America was held in conjunction with the A. I. B. S. convention at the University of Connecticut, August 26 to 30, 1956. On Monday morning following a breakfast for phycologists at the Main Dining Hall, Dr. Jack Myers presided over a symposium on "The Nutrition of Algae," in which Drs. S. H. Hutner, W. H. Thomas, J. C. Lewin, and R. W. Krauss participated. Individual papers were presented at sessions Tuesday afternoon and Wednesday morning. 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. H. C. Bold, at 4:25 p.m., August 28, in Room 320, School of Pharmacy, with 28 members present.

Minutes of the tenth annual meeting (East Lansing, Michigan) were approved as circulated to members in News Bulletin No. 25.

Old Business

Committee on Revision of Constitution and By-Laws

Because of the lack of response from the membership, no action was taken by this committee (J. M. Kingsbury, R. A. Lewin, and R. H. Thompson, chairman).

Committee on International Cooperation Among Phycologists

Dr. G. F. Papenfuss, chairman, presented a detailed report of the activities of his committee (other members: S. H. Hutner, L. Provasoli, P. C. Silva) and their results. In summary, exploratory letters were sent to phycologists in many countries. Favorable reaction was expressed by individuals in Brazil, Canada, Chile, Denmark, Egypt, France, East and West Germany, Great Britain, India, Japan, Netherlands, New Zealand, Sweden and Yugoslavia. Especially strong support came from India and Japan. Lack of keen interest, on the other hand, was noted in France and Great Britain. Many phycologists made suggestions as to the establishment and organization of the proposed international society and as to the operation and editorial policies of the proposed journal. During the discussion that followed the presentation of this report, several proposals were made as to how the Society should proceed at this point. Dr. W. R. Taylor pro-

posed that the officers of the Society be instructed to request the officers of the Ninth International Botanical Congress at Montreal to place the consideration of an international phycological society on their agenda; the time factor was felt to be against this plan. Dr. Luigi Provasoli proposed that an international society be constituted as a federation of existing national societies; the objection was raised that many countries were without national societies. Dr. P. C. Silva proposed that the President be authorized to appoint some member of the Society to contact officers of other national societies and leading phycologists in countries without national societies with the purpose of coöpting a committee to establish an international society. This proposal was approved as a formal motion. It was felt that further pursuit of the project should not stem officially from the Society, but rather from individual members of the Society. (Dr. Papenfuss, in his new capacity as President, appointed Dr. Silva to represent interested members of the Society in coöpting an organizational committee.)

Secretary's Report

A letter from Governor Abraham Ribicoff welcoming the Society to the State of Connecticut was received and acknowleged.

The following officers, nominated by the Nominating Committee (Dr. G. W. Prescott, chairman), were elected on the basis of ballots mailed to the membership in June:

G. F. Papenfuss, University of California, Berkeley.....President
L. A. Whitford, North Carolina State College.....Vice-President
P. C. Silva, University of Illinois.....Secretary
R. C. Starr, Indiana University.....Treasurer

During the past year the membership showed a net gain of 45 and now stands at 259. A gain of 65 new members more than offsets one death (Mr. Frank L. Hess), three resignations, and 20 members dropped for nonpayment of dues. Four former members were reinstated.

Treasurer's Report

Balance on hand, Aug. 15, 1955, as certified by auditors (W. A. Daily and F. K. Daily).....$1520.43

Income

Dues	$526.54
Sale of reprints and back issues	88.30
Interest on savings	10.44
	$625.28

Expenditures

Printing of NEWS BULLETIN	$509.80
Mailing of NEWS BULLETIN	65.18
Auditors' expenses	1.77
Treasurer's expenses	.95

Bank charges	5.22	
President's expenses, 1955	15.27	
	$598.19	
Net income		27.09
Balance on hand, Aug. 28, 1956		$1547.52
Assets		
Checking account, Bloomington National Bank		$ 469.74
Savings account, Bloomington National Bank		1077.63
Stamps		.15
		$1547.52

NEW BUSINESS

Executive Committee's Report

The twelfth annual meeting of the Society will be held in conjunction with the A. I. B. S. convention at Stanford University, August 25-29, 1957.

The Secretary was instructed to write a letter of appreciation to Dr. Jesse F. Clovis, who so excellently served the Society as local representative during the Storrs meetings.

The meeting was adjourned.

Respectfully submitted,
P. C. SILVA,
Secretary.

Necrology

Frederik Børgesen, eminent Danish phycologist and a former member of the Phycological Society of America, died March 22, 1956. Born in Copenhagen January 1, 1866, Børgesen received a doctoral degree at the University in 1904. His major professional post was Librarian at the Botanical Museum, 1900-1935. Of independent means, he traveled extensively. During his exceedingly long and productive career, he established himself as an authority on the marine algae of the Faeroes, the Danish West Indies, the Canary Islands, Ceylon, India, and Mauritius. During his early years he also worked on fresh-water algae.

Haaken Hasberg Gran, dean of planktonologists, died June 2, 1955. He was born in Tønsberg, Norway, April 17, 1870, and took his doctorate under Norum Wille at Oslo in 1902. Gran's first publications dealt with benthic algae, but his interest soon shifted to marine phytoplankton, a field of research in which he became an outstanding pioneer. As early as 1907 he published a method for determining the rate of reproduction of phytoplankton and later, a method for measuring organic production. Gran made the first study of agar-digesting bacteria. (Cf. obituary by Trygve Braarud in Journal du Conseil 21 : 121-124, 1956.)

Richard Kolkwitz, Ph.D., M.D., of Berlin, died April 16, 1956, at the age of 83. Professor Kolkwitz will be remembered by phycologists for his collaboration with Hans Krieger in the preparation of the Zygnematales for Rabenhorst's Kryptogamen-Flora.

North American Desmidiaceae

G. W. Prescott, Michigan State University, and his associates W. E. Wade (also of Michigan State), Hannah Croasdale (Dartmouth), and A. M. Scott (New Orleans) have received a 3-year grant from the National Science Foundation, beginning August 1955, for a study of North American Desmidiaceae. Purposes of the study are (1) to compile for publication the names of all species reported from North America, including those which are to be collected in areas not yet represented in collections; (2) to make chemical analyses of desmid and non-desmid habitats to add to the knowledge of factors determining peculiar distribution of desmids; (3) to compare the desmid flora of North America with that of other regions to determine generalizations concerning the geographical distribution of desmids; (4) to summarize desmid literature and to bring Nordstedt's Index Desmidiacearum up to date; (5) to provide a work of interest and of use to phycologists and limnologists in the United States who have depended too long on European works of this kind. Dr. Prescott and associates invite collections of desmids from all regions of North America, especially those for which habitat notes are available.

Phycological Section of the Botanical Society of America

At the East Lansing meetings, Dr. Harold C. Bold was authorized to present a petition to the Council of the Botanical Society of America requesting consideration of the establishment of a Phycological Section. The Council approved the establishment of this section last fall, with the President and Secretary of the Phycological Society to serve as Chairman and Secretary, respectively, of the Phycological Section. Joint program meetings were held at Storrs. Members of the Botanical Society who wish to affiliate with the Phycological Section should notify the Secretary of the Section.

ABSTRACTS OF PAPERS PRESENTED AT STORRS

Polyploidy in *Chlamydomonas* and its Relation to X-Ray Induced Changes

Donald F. Wetherell
University of Maryland

The progeny of X-irradiated cells of *Chlamydomonas eugametos* Moewus were screened for nutritional mutants by comparing growth curves of these isolates on an inorganic minimal medium with growth curves obtained on minimal medium supplemented with various organic compounds. Seventeen percent of the isolates grew normally on the complex organic medium but exhibited a long lag on minimal medium followed by recovery of normal growth rate. This lag was reproducible and recovery was not due to mutation. It was postulated that the lag-recovery sequence was a manifestation of reduced synthetic capacity resulting from heritable radiation damage to genetic material.

Published chromosome numbers for several species of *Chlamydomonas* immediately suggested the possibility that *C. eugametos* ($n = 36 \pm 4$) was a polyploid. Through the analysis of X-radiation survival curves of a known haploid, *C. reinhardi* ($n = 18 \pm 2$), and a colchicine-induced diploid from this strain, and comparison of these curves with that of *C. eugametos* it was possible to confirm the existence of genetic duplication in the latter species.

From these and other data concerning the growth pattern and requirements of these mutants and a correlation of the lag-mutant behavior with a certain morphologically detectable colony type which occurs at high frequency in irradiated cultures, it has been concluded that the lag-recovery growth pattern on minimal medium arises largely as a result of induced chromosomal deletions in segments of the genome which were originally duplicated because of the polyploid origin of this species. Chromosomal deletion decreases metabolic efficiency and causes a marked reduction in growth rate under unfavorable conditions.

Cold Resistance in Certain Blue-Green Algae

John M. Kingsbury
Cornell University

Eleven species of blue-green algae in nine genera (*Anabaena, Calothrix, Fremyella, Lyngbya, Nostoc, Phormidium, Plectonema, Aphanocapsa* and *Oscillatoria*) were subjected several times to brief periods of exposure to the temperature of liquid nitrogen (—196°C.). In the technique used, small amounts of the organisms are taken on a needle from actively growing agar cultures and are plunged directly into liquid nitrogen where they are kept until several seconds after boiling ceases. They are then removed to fresh agar slants where thawing occurs in a few seconds. With the exception of *Anabaena,* all cultures transferred thus showed resumption of growth of an immediacy and extent comparable to control cultures. *Anabaena* has survived in some experiments but not in others. Similar inocula of these genera, after being frozen to a needle with liquid air, have been plunged into liquid helium (—269°C. or 4° Absolute) until boiling ceased. All recovered as well as when treated with liquid nitrogen, with the exception of *Anabaena* which underwent subsequent cell destruction.

Presence or absence of possible resistance-giving structures (akinetes, heterocysts, firm or diffluent sheaths) has no apparent effect. Six month old and several day old cultures of six genera demonstrated essentially equivalent ability to recover from subjugation to liquid nitrogen. Inocula of *Oscillatoria, Calothrix* and *Nostoc* were subjected to successively lower temperatures between 20°C. and —50°C., being held at each successive interval of ten degrees for five minutes after that temperature had been attained. Resumption of growth was equivalent to that obtained with "snap" freezing.

On Mating Reactions in *Pandorina* and *Eudorina*

Annette D. Wilbois
Indiana University

Pandorina and *Eudorina* are motile, green, colonial algae of the Volvocaceae. *Pandorina* is isogamous and heterothallic, sexual reproduction occurring when colonies of opposite mating types are mixed in the light. By contrast, *Eudorina* is oögamous and either heterothallic or homothallic. In healthy non-mating cultures of both genera there are no single cells, only colonies. Thus, the appearance of single cells is diagnostic of sexual reproduction.

Cultures were maintained in Pringsheim soil-water tubes and matings were effected in watch glasses where gamete production usually required three or four days. All experiments were conducted with bacteria-free unialgal cultures in a constant temperature room at 20°C. with light greater than 350 foot candles from fluorescent bulbs, alternating sixteen hours of light with eight hours of darkness.

Daily crosses of *Pandorina* were tried, using sterile soil-water decantate as a medium. With cultures seven to fourteen days old, zygotes were formed in a few hours after mixing. Younger cultures required two to three days and older cultures would not mate at all. There thus appeared to be a clear correlation between the age of the culture and its mating potential. Dilution of the cell concentration at eight days, keeping the medium constant, did not change the mating ability.

All possible intercrosses of nine pairs of *Pandorina* mating types gave no zygotes nor even gamete formation. Controls gave practically 100% zygotes. This extreme sexual isolation was striking since all strains apparently were morphologically identical and several had been collected from ponds on opposite sides of the same hill.

By contrast, two heterothallic and two homothallic strains of *Eudorina* all intercrossed to a limited degree. The male strain of one of the heterothallic pairs produced zygotes by itself.

It would seem that great variability in sexual pattern exists within these two genera. Work continues in the hope of elucidating the factors controlling the mating reaction and sexual isolation.

Siamese Twins in Studies of *Chlamydomonas* Motility

Ralph A. Lewin
Marine Biological Laboratory
Woods Hole, Massachusetts

Chlamydomonas moewusii is heterothallic. The gametes *(plus* and *minus)* are normally identical and actively motile before pairing. In the sexual reaction, they first make contact by adhesion of the flagella. After cell fusion is initiated by formation of a cytoplasmic bridge, the flagella are freed. Those of the *plus* cell recommence active movement, but those of the *minus* remain immobile.

Twinned cells, common in some UV-induced mutant strains, can be induced to pair. When one of a twain of *minus* cells copulates, the flagella of its sibling, as well as those of the *minus* copulant, cease to move. This is taken to indicate that an inhibitor is transferred across the cytoplasmic bridge from the *plus* cell.

The cells of certain other mutants possess flagella, but are unable to swim. In some of these paralyzed strains, *plus* gametes recover motility after pairing with wild-type *minus* cells. Cell filtrates from normal cells do not induce recovery. Here, too, the use of twinned cells indicates that, since both paralytic twins recover, a factor is transferred across the cytoplasmic bridge from the wild-type partner, in this case restoring activity to hitherto paralyzed flagella.

The nature of these factors remains to be studied.

Morphogenetic Factors in *Ankistrodesmus*

L. H. Tiffany and Rosamond McMillan
Northwestern University

Ankistrodesmus braunii has previously been shown to be highly variable in morphology in the stationary phase of growth, but morphologically homogeneous during the logarithmic phase (McMillan, R. 1955. Ph.D. Dissertation, Northwestern University). An exception was noted in a complex organic test medium, containing 19 amino acids, nitrogen bases, various cofactors and other nutrilites. In this medium morphological variability was marked throughout the logarithmic phase. From this it was inferred that the cells formed specific substances which caused morphological changes when a sufficient concentration was accumulated through several division cycles. Careful study of normal log-phase development under photo-autotrophic conditions revealed that the mechanism producing variation was the inhibition of processes such as elongation and completion of cleavage which normally restore "typical" morphology after cell division or accidents.

Early experiments based on samples from middle log-phase and stationary phase cultures appeared to rule out the notion of Chodat, Vischer and others that glucose is a cause of polymorphism. However, subsequent studies (McMillan, R., and L. H. Tiffany. Bact. Proc. 1956: 41) showed that early log-phase behavior is greatly modified even in relatively low concentrations of glucose; adaptation occurs in low concentrations, such as those of our earlier experiments, so that by the third or fourth division cycle after inoculation the population appears morphologically normal. In all but the lowest concentration tested (0.04%) growth curves showed significant depression or total inhibition in the initial transfers. Concentrations up to 2% permitted some adaptation, either in serial transfers or in initial transfers incubated for very long periods, giving final cell counts which approached those of the controls. Similar effects were observed in fructose, mannose and galactose.

Adaptation of *A. braunii* to high concentrations of glucose is greatly facilitated by excess nitrogen, either as increased nitrate or as organic nitrogen from Difco yeast extract. In such media division continues for a much longer period than in the controls, producing a predominantly sporulated population. These cultures correspond to the "Chlorella-cycles" reported in the early literature by Beijerinck and others. From these experiments it may be inferred that inhibition of cell-division may depend in part upon exhaustion of available nitrogen, while separation and elongation of daughter cells seems to be governed by independent factors, involved in the sporulation cycle.

That "glucose monsterism" is a non-specific reaction is further evidenced by the production of such cells on long-term incubation in pentaerythritol in concentrations equimolar to those of glucose used in earlier experiments. This compound was suggested by S. H. Hutner (personal communication) as a metabolically inert substance to test the effect of increased osmotic pressure. A further screening of some of the components of the original test medium, along with some structural analogues, has shown that most heterocyclic C-and-N rings thus far tested produce the same cytological reaction at the effective level of growth inhibition as do high concentrations of glucose. Exceptions were imidazole and pyridine, which permitted normal cytology as compared with the controls, although growth was as greatly depressed as at inhibitory levels of the other compounds. The possibility that entirely resistant mutants, rather than a mass adaptation of the entire population, gave rise to these populations, should not be overlooked.

The general pattern of monster production in *Ankistrodesmus* closely follows the pattern of inhibition of DNA synthesis or of its structural derangement described for the bacteria by Cohen and Barner (J. Bact. 71: 588-597, 1956), Whitfield and Murray (Can. J. Microbiol. 2: 245-260, 1956) and others. The effective level of uracil inhibition in Cohen and Barner's thymine-less strain of *Escherichia coli*, at 4 μg./ml., is comparable to the inhibitory level of this and related compounds for *Ankistrodesmus*. A study is planned of this alga's normal and abnormal nuclear structure in the presence of division-inhibitory compounds, to elucidate the relation of B_{12} and thymine antagonism or "thymine-less death" to the polymorphism so often reported in the literature.

Yet another morphologieal problem in *Ankistrodesmus* is involved in the lytic cycle frequently encountered in cultures. In both organic and mineral media, cells frequently burst following a division cycle, liberating small clumps or an amorphous mass of protoplasm. At least superficially, these stages are reminiscent of abortive or unsuccessful zoospore production in other green algae, and suggest that *Ankistrodesmus* possesses genetic blocks for necessary steps to successful gamete or zoospore production, which have been circumvented in part by our experimental conditions. Further investigation of this possibility seems warranted.