

1

ALGAL COMMUNITIES AND SOIL MICROENVIRONMENTS IN AN EASTERN WASHINGTON SILT LOAM. B. Metting. Washington State University, 99164, U.S.A.

Fluctuations in diversity and numbers of algae in cultivated and uncultivated portions of a single soil individual were determined at regular intervals in 1977. Numbers of associated bacteria and fungi were estimated as were temperature, water content, and nutrient and ionic properties of the soil microenvironments. The influence of pesticides on algal growth was studied in the laboratory as was the ability of the algae to live in axenic conditions and to utilize simple sugars.

2

CHLOROPHYLL "a" FLUORESCENCE AS A MEASURE OF CELL GROWTH IN A UNIALGAL BIOASSAY. B.H. Rosen. Dept. of Biology, St. Cloud State University, St. Cloud, MN 56301.

A rapid and accurate technique was developed to evaluate the inhibitory or stimulatory effects of pollutants in an aquatic system. *Nitzschia palea* and *Selenastrum capricornutum* were used in a static bioassay of the wastewater effluent from a power plant on the Mississippi River. Live cell counts and fluorometric measurements of *in vivo* and extracted chlorophyll "a" fluorescence were used to calculate growth rates of test algae. *In vivo* and extracted fluorescence were directly proportional to cell density during the exponential growth phase. The growth during the exponential phase was fitted to a non-linear regression model. The ratio of *in vivo* fluorescence: extracted fluorescence increased as the growth rate decreased in *S. capricornutum*; however it remained constant in *N. palea*. The tedium and inaccuracy of cell counts was eliminated by the precision and rapidity of fluorescence measurements after standardization with the particular algae and growth conditions.

3

ATRAZINE EFFECTS ON SALT MARSH EDAPHIC ALGAE (DIATOMS). F.G. Plumley. Auburn University 36830 U.S.A.

The effects of atrazine, a photosynthesis inhibiting herbicide, were assessed on salt marsh edaphic algae in unialgal diatom cultures, laboratory microecosystems, and in the field. A 10^{-5} M concentration of atrazine completely inhibited photosynthesis in cultures of *Nitzschia sigma* and *Thalassiosira fluviatilis* following 7-day exposures. Atrazine, at 10^{-7} M, had no detectable effect on cell numbers, photosynthesis, or chlorophyll level in these cultures, whereas, 10^{-6} M consistently reduced only photosynthesis. Photosynthesis was also reduced in microecosystems and in the field by 5-day exposures to 10^{-5} M atrazine. Chlorophyll and cell numbers were also generally reduced although often not significantly. Diatom species diversity was not appreciably altered by 10^{-5} M atrazine in the microecosystems or in the field. However, the five most dominant species constituted a greater percentage of the total number of individuals present when treated with atrazine.

The least effect level was about 5×10^{-7} M atrazine. The maximum permissible atrazine concentration in estuarine waters, using a 10-fold safety factor, would be about 5×10^{-8} M (0.01 ppm).

4

ALGAL SUCCESSION AS AN EDAPHIC FACTOR OF SURFACE MINED LANDS. T.L. Starks. Department of Biology, University of North Dakota, Grand Forks, ND 58202

Intensive reclamation and revegetation research is being conducted on surface mined lands in North Dakota. Soil samples were collected monthly during the 1975-77 growing seasons from 5 test plots. Results will be reported for the N. Beulah 2 test plot. The soils were analyzed for the presence of algal species, chlorophyll *a*, major cations, anions, and trace elements. Nine species of Chlorophyta, 13 of Cyanophyta, 3 of Bacillariophyta and 1 of Xanthophyta were identified from soil enrichment cultures. A trend analysis showed that time had a positive correlation ($p < .01$) with the number of species and chlorophyll *a* content. Three cosmopolitan species, *Chlorosarcinopsis pseudominor*, *Chlorococcum humicola* and *Nitzschia palea* were found at all sites and dates. Analysis of 1977 soils showed that 9 new species appeared. Evidence of algal succession indicated that a favorable change in the soil chemistry had occurred. Successful revegetation of surface mined lands is dependent on many factors; the soil environment, including microorganisms, is the most important. The presence of algae may be used as an indicator of improving soil conditions for revegetation.

5

BENTHIC ALGAE IN CHESAPEAKE BAY, MARYLAND. J.L. Connor. Horn Point Environmental Laboratories, University of Maryland, Cambridge, Maryland 21613

Studies of the taxonomy, distribution and ecology of the benthic macroalgae were conducted in the upper Chesapeake Bay from February 1977 through March 1978. Field studies of the algae associated with subtidal oyster bars in Maryland's Chesapeake Bay have shown 22 taxa present (12 Chlorophyta, 2 Phaeophyta, 8 Rhodophyta). Investigations at fifteen selected study sites on the occurrence and distribution of these species in relation to seasonal fluctuations of their physical environment were carried out. Seasonal morphological variation and reproductive condition of algae at stations throughout the Chesapeake Bay are compared with previous studies along the North Atlantic Coast.

6

GROWTH AND REPRODUCTIVE STRATEGIES OF *ECTOCARPUS FASCICULATUS* IN A SEASONAL ENVIRONMENT. J.P. Richardson. University of North Carolina, 27514, U.S.A.

Field experiments with artificial substrates demonstrated that *Ectocarpus fasciculatus* was an initial colonizing species during the colder months in inshore North Carolina - its reported southern distribution limit on the east coast. Because it is not apparent during warmer months, laboratory experiments were done to determine the effects of temperature and daylength on growth and reproduction. Growth was not affected by daylength but was inversely related to temperature. Reproduction increased with increasing temperature and was significantly greater under long- and short-day conditions. In addition, a statistically significant interaction between daylength and temperature on reproduction existed. This interaction is interpreted as a life-history adaptation by this opportunistic species to a highly seasonal environment as reproduction is maintained by environmental conditions less favorable for growth. By maintaining dispersion while growth is minimal, this population can colonize whenever space is available, and it is therefore prepared for rapid development at the onset of favorable growing conditions.

7

SHADING EFFECTS OF GAS VACUOLES IN PHYTOPLANKTON POPULATIONS. J. C. Settles. Department of Ecology and Behavioral Biology, University of Minnesota, Minneapolis, Minnesota, 55455 U.S.A.

The attenuation of photosynthetically active radiation (PAR) by gas vacuoles in natural phytoplankton populations was investigated. Gas vacuoles can increase the attenuation of PAR due to their light scattering properties. The increase in attenuation may be viewed as an increased coefficient for attenuation of PAR by algae (E_c) or mechanistically as an increased pathlength (z).

The relative contribution by gas vacuoles to E_c was estimated for algae from two separate basins of Lake Minnetonka, Minnesota. This relative contribution can be used as a quantitative index for comparing the degree of gas vacuolation of different phytoplankton communities. The increases in z due to gas vacuoles were also estimated. Since the effect of gas vacuoles on the attenuation of PAR can be expressed equivalently by increased E_c or z , the choice of expression will depend upon the nature of the investigation. Criteria for the appropriate choice are discussed.

8

THE MORPHOLOGY AND TAXONOMY OF EAST COAST SOLIERIACEAE (GIGARTINALES). P.W. Gabrielson. Botany Dept. University of North Carolina, Chapel Hill, N.C. 27514.

On the east coast of the United States there are two distinct assemblages of species in the family Solieriaceae: those possessing a large central fusion cell and those having a small celled tissue present in the center of the cystocarp. Representative of the former is *Solieria tenera* and *Eucheuma isiforme*. The latter includes *Neogardhiella baileyi*, *N. ramosissima*, *Meristotheca floridana*, and *Eucheuma acanthocladum* or *E. gelidium*. A reinvestigation of European material of *Solieria chordalis*, the type species, has shown that it is nonprocarpic. This is in agreement with the observation of Min-Thein (1976) and properly places *S. tenera* in the genus *Solieria*. The relationship of *Eucheuma* to *Solieria* will be discussed. Of the second assemblage, *N. baileyi*, *N. ramosissima* and *M. floridana* have a similar vegetative anatomy and reproductive development. The vegetative anatomy of the *Eucheuma* species distinguishes them from the above related species. Vegetative and reproductive development and taxonomic affinities of these genera will be discussed.

9

MUTAGENESIS IN EUDORINA ELEGANS (CHLOROPHYCEAE).

A. L. Toby, Simon Fraser University, Burnaby, Canada V5A 1S6

Experiments involving the reversion frequency of an acetate requiring mutant, the frequency of sectorial colonies and the auxotrophic mutant frequency following mutagenesis and enrichment have been used to establish the most effective conditions for mutant induction using the mutagens nitrosoguanidine (NTG) and ultraviolet light (UV).

The data indicate that NTG used at a concentration of 10 $\mu\text{g}/\text{ml}$ for 60 min is the most effective treatment condition for producing auxotrophs. Although UV is not a particularly efficient mutagen for inducing auxotrophs, a dose of 300 Jm^{-2} yields a higher frequency of mutants with changed morphological characteristics than when NTG serves as the mutagen.

10

ELECTROPHORETICALLY DETECTABLE GENETIC VARIATION IN THE FRESHWATER PLANKTONIC DIATOM *Asterionella formosa* Hass.

D. Soudek Jr. Department of Botany, University of Manitoba, Winnipeg, R3T 2N2, Canada.

Asterionella is one of the most common and best known freshwater planktonic algae. It is found in lakes of widely different trophic states. Approximately 100 isolates of this species were obtained from 33 North American and European lakes. Proteins from crude extracts of homogenized batch cultures of each isolate were separated by means of acrylamide gel electrophoresis and stained for general protein and enzyme activity. In addition, the trophic state of each lake was estimated by determining its Secchi depth or total P concentration. General protein and 3 of the 8 enzyme systems examined showed variation in banding patterns. Multiple isolates from the same population appear to be clonal in almost all cases, whereas there are considerable differences among isolates from geographically distant populations and from different lake types.

11

CELLULAR COMPOSITION AND PHYSIOLOGY OF *THALASSIOSIRA FLUVIATILIS* ACCOMMODATED TO CADMIUM STRESS. W.K.W. Li. Department of Oceanography, Dalhousie University, Halifax, Nova Scotia, Canada, B3H 4J1.

Steady-state populations of *Thalassiosira fluviatilis* from continuous cultures receiving 0 and 61 $\mu\text{g Cd}/\text{l}$ were harvested for determinations of cellular components and physiological responses to subsequent cadmium exposure. Compared to cadmium-free control cells, cadmium-stressed cells had elevated amounts of protein, lipid, acid-soluble carbohydrate, ATP, ADP, chlorophyll *a* and carotenoids but similar amounts of DNA, RNA, AMP, chlorophyll *c*, alkali-soluble carbohydrate and insoluble carbohydrate. Dry weight to cell volume ratio, protein to the sum of total carbohydrates and lipid ratio as well as the adenylate energy charge were not different for the two populations. Subsequent exposure of the cells to cadmium over a wide concentration range indicated maximal values of growth rate, photosynthetic C-14 incorporation and extracellular release of C-14 at the cadmium level to which the cells had been adapted in continuous culture. The adaptive and ecological significance of these results will be discussed.

12

FURTHER STUDIES ON BIDDULPHIROID DIATOMS (BACILLARIOPHYCEAE). M. A. Hoban. Texas A&M University, Biology Department, Botany Section, College Station, Texas 77843, U.S.A.

Odontella weissflogii, *O. aurita* var. *obtusa*, *O. anthropomorpha*, *O. edwardsii*, *Cerataulus smithii*, *Trigonium arcticum*, *Triceratium pentacrinus*, *Hemiaulus sinensis*, *Eucampia balaustium* and *Isthmia nervosa*, marine centric diatoms of the suborder Biddulphiineae are examined in the scanning electron microscope. Evidence for resting spores in the antarctic endemic, *O. weissflogii* (Eupodiscaceae) is presented. The familial and generic limits in the suborder are discussed in the light of Ross' recent division of the suborder into two families, the Biddulphiaceae and the Eupodiscaceae.

13

THE ULTRASTRUCTURE OF CELL DIVISION IN *EUGLENA GRACILIS*. M. A. Gollott. Botany Dept. Rutgers University New Brunswick, New Jersey 08903 U.S.A.

Ultrastructure of cell division in *Euglena gracilis* is described. Cells retain motility throughout division. Flagella and basal bodies replicate at preprophase. The reservoir and prophase nucleus elongate perpendicular to the incipient cleavage plane. A basal body pair surrounded by a ribosome-free-zone is present at each pole. A spindle forms within the intact nuclear envelope. At metaphase, the endosome extends from pole to pole, and chromosomes move to the equatorial region. Microtubules attach to trilaminar kinetochores. A dumbbell-shaped nucleus is present by telophase. Daughter nuclei are formed by constriction of the nuclear envelope. Cytokinesis is accomplished by furrowing. These observations demonstrate the existence of a typical mitotic apparatus in *Euglena gracilis*.

14

THE RHIZOPLAST OF *PLATYMONAS SUBCORDIFORMIS* (CHLOROPHYTA) IS A CONTRACTILE ORGANELLE. J. L. Salisbury, Botany Dept., Ohio State University, Columbus, OH 43210, USA.

Banded fibrous roots occur in association with the flagellar and ciliary apparatus of many eucaryotic cells. One such organelle, the rhizoplast of *Platymonas subcordiformis*, has a striking similarity in appearance to myofibrils. The principle observations made in this report are that (1) the rhizoplast is a contractile organelle (2) cyclic contraction is triggered by calcium and ATP and (3) the rhizoplast is linked to the flagellar apparatus and anchored in the plasmalemma.

Detailed ultrastructure of the rhizoplast in the contracted and extended states will be presented. Cytochemical localization of calcium in the contracted, but not in the extended organelle and evidence for rhizoplast-localized ATPase activity will be demonstrated. Calcium localization in vesicles of the anterior end of the cell and their possible role in relation to rhizoplast contraction will be presented. Also, rabbit muscle myosin subfragment-S1 studies and possible mechanisms of contraction will be discussed.

15

STALK INITIATION AND FORMATION BY *COLACIUM LIBELLAE* (EUGLENOPHYCEAE). K.A. Ward. University of Illinois, Chicago, 60680, U.S.A.

Stalk formation in *Colacium libellae* (clone W-15) is characterized initially by adherence of the cell to the substratum by the flagellum. Within 15 minutes, stalk material appears from the canal. After 60 minutes, the flagellum has disappeared. Elongation of the stalk results from continuous deposition of material which gives a specific reaction for carbohydrate with periodic acid-Schiff and alcian blue 8GX.

16

LIGHT AND ELECTRON MICROSCOPIC OBSERVATIONS OF NUCLEAR DIVISION IN THE DINOFLAGELLATE *PERIDINIUM CINCTUM*. D. L. Spector. Department of Botany, Rutgers University, New Brunswick, New Jersey 08903, U.S.A.

Nuclear division in *Peridinium cinctum* has been observed between 7 and 9 hours into the dark cycle. At interphase the nucleus assumes a rounded shape and numerous highly condensed chromosomes are visible. The nucleoplasm appears granular throughout division and the nucleolus is persistent. At prophase the chromosomes appear less dense and prominent bands are present perpendicular to the long axis of the chromosomes. The bands show a periodicity of 57 nm. Fibrous extensions of the chromosomes appear at this stage of division. As division proceeds fibrous connections are seen between chromatids. At later stages of division chromosomes completely uncoil leading to the formation of elongate fibrous structures. Towards the end of division chromosomes begin to recondense and aggregate at opposite ends of the elongated nucleus where they take on the appearance of interphase chromosomes. The dumb-bell shaped nucleus is observed to constrict and pinch into two daughter nuclei.

17

ALGAL INDICATORS OF WATER QUALITY IN THE FLATHEAD RIVER BASIN. G.L. Ennis. Environment Canada, Inland Waters Directorate, Water Quality Lab., 1305 Welch St., N. Vancouver, B.C., Canada. V7P 1B3.

Phycological collections were made in the Flathead River Basin as part of a much larger study designed to assess the water quality of the basin prior to proposed coal developments. Periphytic biomass (chlorophyll *a*) in this Rocky Mountain river are representative of oligotrophic or even ultra oligotrophic systems. Diatoms, represented by 86 species, were the main constituents of the flora. *Hantzschia amphioxys* the dominant diatom is common in many other mountainous, cool water, streams. Other periphytic dominants include the Chrysophyte *Hydrurus foetidus* and the Cyanophyte *Nostoc verrucosum* both of which are adapted to live in the cool, low-nutrient, flowing waters of the Flathead Basin.

Planktonic algae are relatively unimportant and probably derived from sloughed-off periphytic algae. Planktonic cell numbers were low with more dead than live cells and 97 percent of these free floating species are usually found in periphytic assemblages.

18

COMPARISON OF SOME NEW AND OLD INDICES AND MEASUREMENTS OF LAKE TROPHIC STATE. W.D. Taylor, L.R. Williams, S.C. Hern, and V.W. Lambou. U. S. Environmental Protection Agency, Office of Research and Development, Environmental Monitoring and Support Laboratory, Las Vegas, NV 89114, U.S.A.

Thirty-five indices and measurements of trophic state, including 10 new phytoplankton-community-based indices, were used to independently rank a test set of 44 lakes. The rank order of lakes derived with each index was compared independently against two trophic state standards (mean ambient total phosphorus and chlorophyll *a* concentrations). Spearman's Rank Correlation Coefficients (*r_s*) were used to rate the indices. The new phytoplankton indices correlated better against the standards (highest *r_s* = 0.79) than the other community-based algal indices (highest *r_s* = 0.54). Loading models and the Secchi depth index correlated better with mean ambient total phosphorus than did any of the biological indices. The new phytoplankton indices correlated the best with chlorophyll *a* while the loading models and Secchi depth index were poorly correlated with chlorophyll *a*.

19

NEW DISTRIBUTIONS AND HABITAT OF COELASTRUM RETICULATUM VAR. POLYCHORDON KORSCHIKOV (CHLOROCOCCALES) IN INLAND LAKES OF THE UNITED STATES. W. D. Taylor, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Monitoring and Support Laboratory, Las Vegas, NV 89114.

The presence of Coelastrum reticulatum var. polychordon, previously reported to exist in 3 locations (a Russian pond, Sweden, and Lake Huron, U.S.A.), has been verified by the U.S. Environmental Protection Agency in the plankton of 17 lakes from 10 states. Confirmations are expected for an additional 19 lakes and 5 states. Most occurrences were in lakes east of the Rocky Mountains, while the variety was notably absent in a large portion of the far West. Since, to date, this variety has not been found to occur with the common variety, it may be an ecophenotype due to some unknown environmental factor(s). Relationships between occurrence of the variety and physical-chemical factors are evaluated.

20

THE ORIGIN OF VOLATILE SULFIDES IN AQUATIC HABITATS. W.R. Rayburn, Washington State University, 99163, U.S.A.

The ability to detect and measure biogenic volatile sulfides in the ppb range is made possible by gas chromatography. Gas chromatographic analyses of axenic cultures of eucaryotic freshwater and soil algae have failed to detect volatile sulfides. These results are in contrast with reports of volatile sulfides originating from marine macroalgae and marine phytoplankton. The discrepancy of the results shall be discussed and evidence shall be presented for the origin of volatile sulfides in freshwater habitats.

21

PHYSICAL AND CHEMICAL FACTORS INFLUENCING BLUE-GREEN ALGAL SUCCESSION IN TWO SOUTHERN NYS RESERVOIRS. W. H. Shaw, State University of New York at Binghamton, 13901, USA.

The density of blue-green species correlated more frequently and significantly with $\text{NO}_3\text{-N}$ than with soluble $\text{PO}_4\text{-P}$. Nitrogen deprivation in the presence of measurable amounts of phosphorus appears to have affected Coelosphaerium nagelianum to a greater extent than Microcystis aeruginosa while having a stimulating effect on Anabaena spiroides crassa and Aphanizomenon flos aquae. The depletion of $\text{PO}_4\text{-P}$ in addition to $\text{NO}_3\text{-N}$ led to the rapid decline of both species and ultimately to succession by another blue-green alga. Coelosphaerium nagelianum did not prosper at values above pH 8, whereas the other blue-greens encountered, achieved dominance at values up to pH 9.7. A possible role of alkalai and trace metals is indicated. All four blue-green species correlated significantly with water temperature, which may affect the appearance and disappearance of blue-green algal species from the phytoplankton. Stability and vertical mixing within the epilimnion both play significant roles, the former by fostering localized nutrient depletion, and the latter by preventing or moderating nutrient limitation.

22

TOXICITY AND BIOCONCENTRATION OF THE HEAVY METAL CADMIUM IN SCENEDESMUS OBLIQUUS (CHLOROPHYCEAE). J. R. Cain, D. C. Paschal, and C. M. Hayden. Illinois State University, Normal, Ill., 61761, U.S.A.

A laboratory study was conducted to determine the ability of Scenedesmus obliquus to tolerate and accumulate cadmium. The alga was cultured in a chemically-defined medium containing cadmium concentrations ranging from 0.01 PPM to 4.00 PPM. Growth, measured as doublings made by an inoculum population during a 14-day growth period, was not substantially affected by cadmium concentrations of 1.00 PPM or less. At concentrations above 1.00 PPM, however, growth was inhibited significantly. Bioconcentration of cadmium was observed in all media and the extent of accumulation was dependent upon the concentration of cadmium in the medium. The amount of cadmium in and/or adsorbed onto the algal cells was from 300-5000 times higher than the amount present in the original culture medium. The largest concentration step occurred in a medium containing 0.25 PPM cadmium. Results indicate that Scenedesmus obliquus can accumulate significant amounts of cadmium even when concentrations external to the algal cells are at levels which do not affect growth.

23

SALINITY ADAPTATIONS OF A RECENT MIGRANT INTO THE GREAT LAKES, BANGIA ATROPURPUREA (RHODOPHYTA). R.G. Sheath and K. Cole. Dept. of Botany, Univ. of British Columbia, Vancouver, B.C. V6T 1W5, Canada.

In a survey of the distribution of B. atropurpurea along the St. Lawrence Great Lakes it has been observed that this species is concentrated in the lower lakes. Studies have been conducted to determine the response of this alga to a wide range of media and salinities. Germlings obtained from applanospores exhibited varying abilities to grow at different salinities which was in direct relationship to the osmolarity at which the parent plants were preincubated. By the second and third generations, germlings obtained from plants grown in seawater showed a definite preference for higher salinities, 19‰ and 25‰, respectively. Original populations exhibited no loss of photosynthetic rate as salinity was raised to 13 ‰. At 26 ‰ the rate was reduced by one-half and thylakoids were rearranged to from irregular, vesicular units.

24

ALGAL SUCCESSION AND CHRONOSEQUENCES ON ABANDONED MINE SPOILS. L.E. Shubert and T.L. Starks. Department of Biology and Project RECLAMATION, University of North Dakota, Grand Forks, ND 58202

Soils were collected from spoil material aged 0-45 years. The soils were analyzed for the presence of algal species, chlorophyll a , major cations, anions and trace elements. There was a gradual increase in the number of algal species and chlorophyll a from 1 year old spoils to adjacent unmined natural sites. A total of 41 algal species were identified from all sites. Several species were only found at the unmined sites and they may represent a stable algal community. Results of a statistical analysis on the litho- and chronosequence of the soils will be discussed.

Supported by Grant #G0264001 from USDI, Bureau of Mines

25

TIME SERIES ANALYSIS AND FORECASTING OF PHYTOPLANKTON DYNAMICS AND SELECTED LIMNOLOGICAL PARAMETERS. W. L. Poppe. Dept. of Botany, S.E. 401, University of Arkansas, Fayetteville, Ark. 72701.

Time series statistical analysis was performed on a multi year data set collected from a small reservoir in northwest Arkansas. Model identification, coefficient estimation and forecast estimations were developed for total algae, chlorophyll, temperature and dissolved oxygen series. Forecasts for each series exhibited less variation than the original series. The lack of sensitivity was most pronounced at times of rapid change, i.e. constantly changing positive and negative slopes, in the original series. The forecasts were however within biological reason throughout the comparison with the real data. The application of time series analysis to cyclic biological, physical and chemical data appears to be an efficient method of statistical examination. The forecasts generated by these models exhibited desirable values which could be used to generate future values in the observed series.

26

A COMPARISON OF ALGAL COMPOSITION AND SEASONAL SUCCESSION BETWEEN TWO CENTRAL OKLAHOMA FARM PONDS. Terry L. Wright and Lois A. Pfeister. Ecology Consultants, Inc., 1716 Heath Parkway, Fort Collins, Colorado, 80522. U.S.A. and University of Oklahoma, 73019, U.S.A.

The influence of pond substrate on algal composition and annual succession was studied for one year in two Oklahoma farm ponds, one having a clay substrate and the other sandstone. Consideration was also given to pH and temperature changes during the year. One hundred and thirty species of algae not previously reported for Oklahoma have been added to the algal flora as a result of this study.

27

THE EFFECTS OF THERMAL EFFLUENT ON PHYTOPLANKTON POPULATIONS IN LAKE ARLINGTON, TEXAS. A. W. Hopkins. The University of Texas at Arlington, 76019, U.S.A.

Phytoplankton populations from Lake Arlington were sampled on a three week interval for one year (1977-78). Two stations were sampled: the intake to and the outflow from the Texas Electric Service Co. Handley power plant. The yearly mean temperature difference between the two stations was 3.7°C.

The samples were analyzed for total organisms, total photosynthetic surface area, and chlorophyll a concentration. Within a station, significant correlation coefficients were found between all pairs of the 3 parameters. Between the two stations, significant differences in the parameters were found only in chlorophyll a concentrations and only during the warmest parts of the year. At these times, the values in the heated water were lower but by less than 10%.

28

ALGAE OF EXTREME ENVIRONMENTS ON MOUNT SHASTA, CALIFORNIA. R.A. Wharton, Jr., Department of Biology, Humboldt State University, 95521, U.S.A.

Results of phycological investigations of the snowfields, glaciers and summit thermal springs are reported. *Chlamydomonas nivalis* appears to be the most abundant cryophilic species and is most often responsible for observed blooms of red snow. The cryophilic flora of Mt. Shasta may represent a transition zone between the less diverse Sierra Nevada flora and the more diverse flora of the Oregon and Washington Cascades. The possibilities of using remote sensing techniques for identifying the location and mapping the development of snow algae blooms are discussed. *Cyanidium caldarium* is reported from the summit thermal area which represents a new distributional record for this thermophilic alga in California.

29

FIELD AND LABORATORY STUDIES OF *VAUCHERIA LITOREA* AND *V. LONGICAULIS* (XANTHOPHYCEAE). R.A. Pecora. University of Southwestern Louisiana, 70504, U.S.A.

Vaucheria litorea and *V. longicaulis* were identified from several locations in coastal Mississippi and Louisiana from 1975 to the present. Sexual plants of *V. litorea* were observed in 11 of 13 collections made between October and December while sexual plants of *V. longicaulis* were identified from 2 of 12 collections made from November to March. Both taxa were identified from freshwater and low salinity habitats. *Vaucheria longicaulis* mats contained no other *Vaucheria* species while *V. litorea* often grew with *V. dillwynii*, *V. erythrospora*, *V. racemosa*, *V. sessilis*, *V. taylorii*, or *V. thuretii*. Gametangia were produced after incubation of portions of algal mats at 14-16 °C on a 12:12 LD photoperiod. Clonal cultures of both species grew in modified ASP-6 medium containing 3% soil extract. Two isolates of *V. longicaulis* have been maintained in Bold's Basal Medium since January 1978. Except for reduced size of the oogonia in cultured (ASP-6) *V. longicaulis*, no significant alteration in vegetative or reproductive morphology was observed. Release of sperm at the termination of the dark portion of the photoperiod was observed in cultured *V. litorea*.

30

A PRELIMINARY INVESTIGATION OF THE ALGAL FLORA IN THE SEDIMENTS OF LAKE ERIE. V. Ray Frederick and Glenn C. Millner. Great Lakes Laboratory, State University College, Buffalo, New York 14222

The algae in a 45 cm long sediment core taken in the Eastern Basin of Lake Erie, 12 km northwest of Dunkirk, New York, were examined at 2 cm intervals using the Utermöhl technique. Members of the Bacillariophyceae were by far the most abundant taxa identified at all sediment levels with greater numbers of frustules/cm³ occurring in the intermediate sediment depths. *Stephanodiscus niagarae* and *Melosira italica* were most frequently encountered; while *S. astraea* and *Tabellaria fenestrata* as well as various other taxa were less common in the sediments. Although much less abundant in the sediments, the non-diatom algae were represented by the Desmidiaceae and Chlorococcales. *Cosmarium formulosum* and *Staurastrum gracile* were most commonly encountered in the sediments.

31

PRIMARY PRODUCTIVITY IN HIGH RATE SEWAGE OXIDATION PONDS. T. Berner, Z. Dubinsky and G. Shelef. Department of Biology, Oranim, Haifa University K. Tivon, Israel and Department of Life Sciences, Bar Ilan University, Ramat Gan, Israel and Sherman Environmental Engineering Research Center, Technion, Haifa, Israel.

As part of a joint Israeli-German project aimed at algal waste water treatment and protein production, the primary productivity in high rate oxidation ponds was measured. In order to optimize pond operation, the detailed photosynthesis depth profile was studied by the ^{14}C incorporation method. To achieve sufficient resolution in the dense shallow pond, a special device was developed.

Our results show light inhibition in the upper 5 cm of the pond and light limitation beginning at 15-20 cm. depth. Primary productivities measured were $3 \text{ gr. m}^{-2} \text{ day}^{-1}$ in January to up to $25 \text{ gr. m}^{-2} \text{ day}^{-1}$ in May and light efficiency utilization of 0.9 to 3.4%, respectively.

32

A COMPLEX LIFE CYCLE OF A CHLOROMONAS FROM SNOW (CHLOROPHYTA, VOLVOCALES). Ronald W. Hoham, Stephen C. Roemer and John E. Mullet. Colgate University, Hamilton, N.Y.

The life cycle of a species of the volvocalean genus, *Chloromonas*, was studied from snow near Cayuse Pass, Mt. Rainier National Park, Washington. Several taxa of snow algae placed in the Chlorococcales were found to be variations in the zygote of this *Chloromonas*. These taxa include *Cryocystis brevispina*, *Cryocystis japonica*, *Cryodactylon glaciale*, *Oocystis lacustris* f. *nivalis*, *Trochiscia cryophila*, *Trochiscia nivalis* and *Trochiscia rubra*. It was concluded that *Cryocystis* and *Cryodactylon* are not valid genera since both are phases in the zygote of a biflagellate. The vegetative cells of this *Chloromonas* cleave into 2, 4 or 8 daughter cells which behave as zoospores or gametes. Sexual reproduction is usually anisogamous, but sometimes isogamous. The planozygotes have four flagella which are spaced 90° apart. Observations of these species were made using phase-contrast, Nomarski-interference-contrast and scanning-electron microscopy. Vegetative cells were isolated into M-1 medium which was designed for culturing snow algae. Environmental factors pertaining to developmental stages in this *Chloromonas* are discussed where known.

33

IS NORTH CAROLINA A TRANSITIONAL BENTHIC ALGAL PHYTOGEOGRAPHIC ZONE IN THE WESTERN ATLANTIC? C. W. Schneider and R. B. Searles, Dept. of Biology, Trinity College, Hartford, Ct., 06106 and Dept. of Botany, Duke University, Durham, N.C., 27706, USA.

The unique geologic and hydrographic features of the Carolina coastline and continental shelf are discussed as well as their implications to the distribution of benthic marine algae in the western Atlantic. Two distinct floral entities are described for North Carolina, the "jetty" and "shelf" florae, and reasons for their segregation are argued. Of 280 species of red (162, 58% of the flora), green (61, 22%) and brown (57, 20%) seaweeds (excluding crustose corallines, pelagics, and questionable records) in this area, 116 (41%) are restricted to the "jetty" flora, 101 (36%) to the "shelf" flora, and 63 (23%) are shared by both florae. Within the "jetty" flora 28 (16%) of the species reach their southern limit of distribution here, 68 (38%) their northern limit, and 71 (40%) have no boundary in the Carolinas. Within the "shelf" flora, 5 (3%) reach their southern limit, 118 (72%) their northern limit, and 32 (20%) have no boundary here. The dwindling number (10 spp., 4%) of North Carolina endemics is discussed. These current data are compared with statistics collected 50 years ago in North Carolina for its algal flora.

34

OBSERVATIONS ON THE MARINE ALGAE OCCURRING FROM 30-100 METER DEPTHS ON THE EAST COAST OF FLORIDA. N. J. Eisman. Harbor Branch Foundation, 33450, U.S.A.

Marine Chlorophyta, Phaeophyta, and Rhodophyta are being sampled seasonally along depth gradients on the East Coast of Florida by lockout divers from the JOHNSON-SEA-LINK submersibles. Members of the Siphonales, Dictyotales, Cryptonemiales, Rhodymeniales, and Delesseriales dominate the flora. Large, typically flattened or foliose forms are most common down to 40m depth. Below 40m crustose, filamentous, and monostromatic species increase. There appears to be an association of species extending to 40m depth, a transitional zone from 40-60m, and another association of species from 60m to an undetermined depth. The flora at 100m is most unique. Species richness varies seasonally. New distributional records are given. Implications of this work to larger questions of seasonal stability, zonation, and biogeography of deep water algae are discussed.

35

COMPARATIVE STUDIES OF POLYSIPHONIA URCEOLATA (LIGHTP.) GREVILLE FROM THREE NORTH ATLANTIC SITES. D. F. Kapraun, Dept. of Biology, Univ. of North Carolina, Wilmington, N.C., 28401, USA.

Isolates of *Polysiphonia urceolata* from North Carolina, New Hampshire, and Norway were investigated in cross-gradient light-temperature culture to determine the effects of light intensity, photoperiod, and temperature on their growth and reproduction. Variations in the isolates' responses suggest that regional patterns of seasonal growth and reproductive periodicity reported in the literature are primarily a result of annual temperature cycles, but light intensity (MDI) is also implicated. Comparisons of reproductive and vegetative characteristics in material from nature revealed that populations in these three sites are morphologically distinguishable. These results are discussed in terms of *P. urceolata* consisting of latitudinally distributed ecotypes, or alternatively, sibling species.

36

PHYSIOLOGICAL ECOLOGY OF TEMPERATURE SEAWEED POPULATIONS. B.H. Brinkhuis, Marine Sciences Research Center, State Univ. of New York, Stony Brook, N.Y., 11794, USA.

The ecology of intertidal seaweed populations has only recently been explored in terms of physiological and morphological adaptation to a variety of environmental parameters. Photosynthetic capacity throughout the year appears to be more closely related to seasonal variations in irradiation than to changes in temperature. In intertidal salt-marsh populations, photosynthetic potential of fucoids is controlled by the presence or absence of light-absorbing canopies of phanerogam vegetation. The perennial fucoids exhibit maximum photosynthetic capacity during the spring months, before phanerogam canopies develop. Similarly, salt-marsh fucoids exhibit a morphological gradient in relation to vertical distribution, i.e. duration of exposure to the atmosphere. Such morphological gradients appear to be common in salt-marsh fucoid populations. However, within the same species there does not appear to be a gradient in photosynthetic potential with increasing desiccation of plant tissues. The reason appears to be that a given species is physiologically well adapted to a wide range desiccation degrees. Some recent investigations by others have indicated that this adaptation may also include cytological adaptations.

37

THE DISTRIBUTION, COMPOSITION AND PHENOLOGY OF NEW ENGLAND ESTUARINE SEaweEDS. A.C. Mathieson, Jackson Estuarine Laboratory, Univ. of New Hampshire, Durham, N.H., 03824, USA.

The spatial distribution and composition of seaweeds within the Great Bay Estuary System of New Hampshire-Maine are described. A "typical" estuarine reduction pattern was recorded. Disjunct coastal populations were also recorded in estuarine tidal rapids. Four major floristic components are described within the Estuary based upon their centers of distribution north or south of Cape Cod, Massachusetts. Basically, coastal portions of the Estuary are dominated by cold water perennial species (northern and cosmopolitan-northern), while the upper Estuary has a seasonally dynamic warm water flora (cosmopolitan-southern). A comparison of the seasonal phenology of seaweeds is described from the open coast to an upper tidal tributary. The spatial and seasonal floristic patterns are related to a variety of hydrographic parameters.

38

DISTRIBUTION OF ELECTROMORPHS AND GROWTH RATE CHARACTERISTICS IN ISOLATES OF *THALASSIOSIRA PSEUDONANA* FROM THE NERITIC OCEANIC BOUNDARY. L.S. Murphy, R.R.L. Guillard, H.-t. Lee and L.E. Brand. Woods Hole Oceanographic Institution, 02543. U.S.A.

The panthalassic diatom species *Thalassiosira pseudonana* consists of neritic and oceanic ecological races that have been characterized by electrophoretic banding patterns, physiological characteristics, and minor morphological differences. Here, we compare clones of *T. pseudonana* recently isolated from the neritic-oceanic boundary with established clones from neritic and from oceanic waters. Results show that these new clones share characteristics with both the neritic and the oceanic races. They are not simple F_1 hybrids, and, unlike the neritic and oceanic races which are each highly homogeneous, there is much variability among these boundary clones. New clones from the outer shelf more closely resemble the neritic race, while new clones isolated from a warm core ring overlying the slope are more similar to the oceanic race. It appears that the boundary zone does not contain a distinct and homogeneous ecological race, but rather, it is a broad zone of hybridization between two races or semispecies.

39

PHYTOPLANKTON IN THE MANGANESE NODULES PROVINCE OF THE TROPICAL PACIFIC. G.A. Fryxell, S. Taguchi, and S.Z. El-Sayed. Texas A&M University, 77843 USA and University of Hawaii at Manoa, 96744.

Phytoplankton was analyzed quantitatively from discrete water samples from 4 or 5 depths of 15 stations occupied SE of Hawaii from the Deep Ocean Mining Environmental Study (DOMES) cruises in the fall of 1975 and spring of 1976. Species diversity was higher in the fall than in the spring; high diversity was correlated with low phytoplankton standing crop. Cell counts were inversely related to nutrients in the water column, especially nitrates. *Gephyrocapsa huxleyi* (Lohmann) Reinhardt accounted for about 25% of the total phytoplankton count at the chlorophyll *a* maximum. Empty cell counts were about an order of magnitude less than full counts, indicating not only low sedimentation rate, but also recycling of cell contents within the euphotic zone itself. 163 diatom, 122 dinoflagellate, and 48 coccolithophorid taxa were identified, with roughly similar numbers of cells/l from each group, each averaging 3-5,000 cells/l throughout the water column studied. The typical profile of cell numbers showed a subsurface maximum and gradual diminution with depth.

40

EFFECT OF TEMPERATURE ON THE GROWTH RESPONSE OF THE MARINE DIATOM *SKELETONEMA COSTATUM* TO LIGHT VARIATION. G.L. Hitchcock. Graduate School of Oceanography, University of Rhode Island, 02881. U.S.A.

Spectral analysis of daily light intensity (I_0) over Rhode Island during the spring and summer months yield low autocorrelation coefficients for consecutive days; thus phytoplankton in well-mixed Narragansett Bay are subject to wide variations in daily light intensity. Natural diatom blooms incubated in dialysis at 100%, 50%, 25% and 3% I_0 show the dominant diatom *Skeletonema costatum* attained maximum growth rates at I_0 or 0.50 I_0 after two days at 20C (summer bloom). During the spring bloom growth rates varied by < two-fold at I_0 to 3% I_0 during 4 day incubations. Axenic *S. costatum* cultured at 20C exhibited growth rates proportional to intensity after 12 h; at 10 C growth rates did not vary until 24 h (second photoperiod) and at 2C rates were equal throughout 36 h. Four other marine diatoms exhibited similar responses *in vitro*. Thus the *in situ* growth rates of diatom species may closely reflect daily variations in light intensity during the summer, but require longer periods to respond to changes in light during the spring bloom periods when temperature is lower.

41

THE EFFECTS OF ARSENIC SPECIATION ON ITS TOXICITY TO MARINE PHYTOPLANKTON. J.G. Sanders. Skidaway Institute of Oceanography, P.O. Box 13687, Savannah, Georgia, 31406, U.S.A.

Arsenic in seawater is predominately in the form of arsenate ($As(V)$). Small amounts of arsenite ($As(III)$) and dimethylarsinic acid (DMA) are present due to biological reduction and methylation. $As(V)$, a chemical analogue of PO_4^{3-} , is taken up indiscriminately by the cell and inhibits the phosphate active transport system and oxidative phosphorylation. $As(V)$ inhibits cell growth and photosynthesis at concentrations greater than $5 \mu g \cdot l^{-1}$, in phosphate-limited cultures. The $As(V)$ incorporated is reduced and methylated within the cell, forming the more mobile $As(III)$ and the non-reactive DMA. This reduction and methylation of the arsenic effectively relieves its toxicity, since DMA is not inhibitory, even at concentrations greater than $25 \mu g \cdot l^{-1}$. The toxicity of $As(III)$ is difficult to establish, due to its rapid chemical oxidation to $As(V)$. When phosphate is present, very little $As(V)$ is incorporated, and no inhibition occurs.

42

STUDIES ON DIURNAL MIGRATION IN MARINE PHYTOPLANKTON. R.D. Staker and S.F. Bruno, New York Ocean Science Laboratory, Montauk, N.Y. 11954, U.S.A.

Sampling of water for field observations was carried out hourly over a diel period. These samples were collected during the summer in neritic waters at 0, 1, 3, 5, 7, 10, and 13 m-depths. A 1 liter aliquot of water was drawn from each sample and concentrated to 10 ml. Cell counts and identification were made using a Sedgewick-Rafter cell. The entire contents of the 1 ml subsample were analyzed for diatoms, dinoflagellates, and silicoflagellates. An analysis of variance (t-test) on the data comparing the variation in the mean depth during the daylight hours to the night hours was performed in order to test whether the variations were due to chance alone. Results of the t-test indicate that *Prorocentrum redfieldii*, *P. micans*, *Ceratium tripos*, *C. fusus*, and *Peridinium granii* undergo diurnal vertical migration.

An experimental tank, 2.0 x 0.5 x 0.5 m was constructed for lab work designed to test the comparative rates of migration and the effects of continuous illumination on the migration pattern of various cultured dinoflagellates. Results of these experiments will be reported.

43

TAXONOMY AND COMMUNITY STRUCTURE OF DIATOMS EPIPHYTIC ON SEAGRASSES IN MISSISSIPPI SOUND. Michael J. Sullivan. Botany Department, P. O. Drawer BD, Miss. State, Mississippi 39762

Epiphytic diatoms were collected on 20 July 1977 from the leaves of 3 seagrasses growing in the sandy sediments of Mississippi Sound. The seagrass species included *Halodule beaudettei*, *Syringodium filiforme*, and *Thalassia testudinum*. Examination of cleaned material under the light and scanning electron microscopes revealed a total of 37 diatom taxa epiphytic on the 3 seagrasses. The 4 most abundant diatoms were *Fragilaria hyalina*, *Mastogloia pusilla*, *Licmophora cf. debilis*, and *Opephora pacifica*. Except for the rare taxa, the taxonomic composition was identical regardless of the seagrass examined. Based on counts of ca. 1000 individuals, values of community diversity statistics (H' , S , and R') were virtually identical for the epiphytic diatom samples. Use of a selected similarity index (SIMI) revealed that any 2 samples shared between 82 and 88% of the maximum similarity possible. Therefore, the available taxonomic and structural information suggest that the above 3 seagrasses support a single, nearly homogeneous epiphytic diatom community during the summer months.

44

INTERACTION OF EPIPHYTIC DIATOMS AND BACTERIA CULTURED ON *ZOSTERA MARINA* L. (EELGRASS) DETRITUS. Paul Garth Harrison. Department of Botany, University of British Columbia, Vancouver, V6T 1W5, Canada.

In 14 day old batch cultures diatoms were rarest (35 mm^{-2}) and bacteria were most common ($9 \times 10^4 \text{ mm}^{-2}$) on fresh detritus. Diatoms were more common on fresh or aged detritus previously extracted with aqueous methanol ($50\text{--}100 \text{ mm}^{-2}$) and densest on aged particles (120 mm^{-2}). Bacteria were less abundant on these latter substrates especially on the extracted, fresh detritus ($2 \times 10^4 \text{ mm}^{-2}$) from which most of the soluble materials (36% of dry wt) had been removed. The ratio of bacteria to diatoms ranged from 140 to 2040 but when inorganic nutrients were added the ratios for all four substrates were similar (740–840) and the ranges of densities of diatoms and bacteria were narrower than in unenriched controls. The response of both autotrophic and heterotrophic components of the systems to inorganic nutrients is affected by the nature of the organic substrate and by competition. Bacteria are favoured on fresh, easily assimilated detritus and hence diatoms will be nutrient-limited. When nutrients are plentiful the nature of the detritus is less important.

45

POPULATION DYNAMICS OF *OLISTHODISCUS LUTEUS* (CHRYSO-PHYCEAE) IN NARRAGANSETT BAY, RHODE ISLAND. C.R. Tomas. Graduate School of Oceanography, University of Rhode Island, Kingston, R.I. 02881 U.S.A.

Phytoplankton observations spanning 17 years in Narragansett Bay showed persistently recurrent blooms of the flagellate *Olisthodiscus luteus*. Maximum abundances occurred as mid-summer and fall peaks separated by a period of low abundance. *O. luteus* was absent from surface water during January–March of each year. Summer abundances reached $10^5 \text{ cells} \cdot \text{ml}^{-1}$ in several regions when temperature, light intensity and phosphate levels were at maximum but when nitrogen was at a seasonal minimum. Autecological studies with *O. luteus* showed the formation of a dark resistant benthic phase, effects of temperature and salinity on growth, survival and motility, features of uptake and utilization of nitrogen and phosphorus, and effects of temperature and light on photosynthesis. An integration of these studies with field observations are presented to define the population dynamics of *O. luteus* in Narragansett Bay.

46

LIFE CYCLE, SEASONALITY, AND EFFECTS OF TEMPERATURE AND SALINITY ON GROWTH AND SURVIVAL OF *PYRAMIMONAS AMYLIFERA* (PRASINOPHYCEAE). W.E. Gardiner and P.E. Hargraves. University of South Florida, 33620, U.S.A. and University of Rhode Island, 02881, U.S.A.

Several possible life-cycle stages of a clone of *Pyramimonas amyliifera* have been encountered in cultures. These include: 1) octoflagellates, 2) quadriflagellates, 3) biflagellates, 4) cysts, and 5) multilobate cells, each lobe of which possessed 8 flagella. Scanning electron microscopy revealed the presence of body scales on biflagellates of the type which form the middle layer of body scales on the octoflagellates.

The seasonality of a salt-marsh population of *P. amyliifera* was studied in relation to temperature and salinity. Its abundance reached 2 peaks in a 12-month period, one before, and one after its pool habitat was covered with ice. Cysts, but no flagellate stages of this organism, were found in the pool during the summer.

Growth experiments indicate that a temperature between 10 and 15 C is optimal, and between 20 and 25 C is the maximum tolerable by this clone. Also, the salinity tolerance range of this clone decreases with increasing temperature.

47

ON THE ECOLOGICAL AND EVOLUTIONARY SIGNIFICANCE OF VEGETATIVE REPRODUCTION IN SEaweEDS. D.P. Cheney and A.C. Mathieson. Jackson Estuarine Laboratory, Durham, N.H., 03824.

The significance of vegetative reproduction as an important adaptive mechanism in the reproductive strategy of seaweeds is discussed citing examples from *Chondrus* and *Eucheuma*. Vegetative reproduction may play a far more important role in the survival of populations than has been generally appreciated, and in particular, may often be a mechanism insuring the production of favorable genotypes. For example, the perennial holdfast system of *Chondrus crispus* is an important antiherbivore adaptation that provides a competitive advantage in the intertidal zone. Grazing experiments conducted in the laboratory with the herbivore *Littorina littorea* demonstrated that *Chondrus* holdfasts and shoots were resistant to grazing from a very early sporling stage. Vegetative reproduction also has a profound effect on the genetic structure of populations. For example, using electrophoretic techniques, significant deficiencies of heterozygotes were observed at 2 acid phosphatase loci in offshore, Floridian populations of *Eucheuma isiforme* that showed a propensity for vegetative reproduction via regeneration of plants from branch fragments & residual holdfasts.

48

ACCLIMATION RESPONSES TO SALINITY OF THREE ESTUARINE RED ALGAE FROM NEW JERSEY. C. Yarish, S. Casey, and P. Edwards. University of Connecticut, Rutgers University and Asian Institute of Technology.

The investigation concerned the effects of acclimation time and salinity on the next photosynthetic responses of three estuarine red algae, *Caloglossa leprieurii* (Mont.) J. Ag., *Bostrychia radicans* Mont. and *Polysiphonia subtilissima* Mont. The algae were immersed in media of salinities 0, 5, 15, 25 and 35 ‰, and were held for periods of 0, 2, 4, 8 and 16 days. The rates of photosynthesis of non-acclimated plants at extreme high and low salinity were generally higher than in plants acclimated in that salinity. The optimal acclimation time of *Bostrychia* was between 0 and 4 days and that of *Caloglossa* was at 4 days. *Polysiphonia* showed no significant difference in responses for any acclimation time over the broad range of salinities. The data indicated that *Bostrychia* was limited by salinities less than 15 ‰ and greater than 25 ‰, that of *Caloglossa* and *Polysiphonia* were limited by salinities less than 5 ‰ and greater than 25 ‰. The patterns of the net photosynthetic responses of these estuarine algae were correlated with the salinity regimes of their original habitats.

49

THE ADAPTIVE SIGNIFICANCE OF THE TURF GROWTH FORM: AN ENUMERATION OF THE COSTS AND BENEFITS OF COLONIALITY IN MARINE MACROALGAE. M. Hay. Smithsonian Tropical Institute, Panama Canal Zone.

The costs and benefits of coloniality were analyzed for three abundant turf-forming species (*Dictyota bartayresii*, *Halimeda opuntia* and *Laurencia papillosa*) from the Caribbean coast of Panama. In all cases the net productivity of colonies was significantly lower than that of individuals but individuals suffered greater biomass loss to herbivores and greater physiological damage during desiccating low tide conditions.

The upper portions of thalli showed significantly greater rates of net photosynthesis and of dark respiration than did the lower portions. The effects of this spatial partitioning are discussed in terms of increased energetic efficiency and increased persistence during severe environmental conditions.

Coloniality in marine macroalgae is an adaptation which increases persistence in space and time but decreases immediate productivity.

50

CARBON FLOW IN MACROPHYTE COMMUNITIES OF A NORTH TEMPERATE ESTUARY. M.N. Josselyn and A.C. Mathieson. Department of Botany and Plant Pathology, University of New Hampshire, Durham. 03824.

A model based on empirical data is presented which simulates carbon cycling through benthic and intertidal communities of the Great Bay Estuarine System in New Hampshire. The species of primary interest are *Spartina alterniflora*, *Zostera marina*, *Ascophyllum nodosum*, and *Fucus vesiculosus*. Data on detrital fluxes and decomposition rates are used to compare the significance of each species to the detrital pool. Radiotracer experiments provided information on dissolved organic carbon (DOC) release from decomposing plant material. Although release rates differed between seaweeds and vascular plants, the DOC was immediately utilized by bacteria and mineralized to CO_2 . The model utilizes the experimental data to describe, on a seasonal basis, the net carbon uptake, storage, and subsequent release through decomposition for each plant species.

51

SPATIAL DIFFERENCES IN STRUCTURE AND DEVELOPMENT OF A SUBTIDAL NORTH CAROLINA COMMUNITY. P. Hyland and R.B. Searles. Duke University Marine Lab, 28516, U.S.A. and Duke University, 27706, U.S.A.

Two areas of a rock platform offshore North Carolina are compared to determine the influence of abiotic and biotic factors on the control of structure and development. Samples taken within one meter of the rock platform edge show lower biomass, diversity, and percent cover values when compared with samples from an area 10 meters from this edge. Individual species distributions vary in these two areas: perennial Phaeophyta are almost entirely excluded from the area near the edge, where annually fluctuating populations of Rhodophyta predominate. Patterns of development on introduced substrates also differ in the two areas indicating that survivorship and growth characteristics vary in these two locations. Measurement of physical factors along with herbivore exclusion experiments indicate that differences in current flow and wave surge along with variation in grazing pressure in the two locations may contribute to the observed differences in structure and patterns of development.

52

BIOGEOGRAPHICAL ANALYSIS OF THE MACRO-ALGAL FLORAS OF THE SOUTHERN CALIFORNIA ISLANDS. S.N. Murray. Dept. Biol. Sci., California State University, Fullerton, CA, 92634.

Due to their location near Point Conception, CA (34.5°N), a major faunal and floral boundary in the NE Pacific, the Southern California Islands are of extreme importance to the understanding of the biogeography of California. The purpose of this paper is to provide a distributional analysis of the macro-algal floras of the eight islands to determine their biogeographical relationships with each other and with the adjacent mainland. The similarity between island floras was determined by quantitative analyses of binary data. Analytical methods included: 1) interpretations of a similarity matrix based on the Dice Coefficient, 2) computer-mediated classification analysis employing the Jaccard Coefficient of association, 3) ordination by principal coordinate analysis. Three island groups were consistently recognized in these analyses and the established macro-algal affinities appear to be related to surface water temperatures in the Southern California Bight. Additionally, the island floras showed highest similarity with the mainland flora to the south of Point Conception based upon range-overlap comparisons.

53

NITROGEN LIMITATION OF *CODIUM FRAGILE* SUBSP. *TOMENTOSOIDES* AS DETERMINED BY TISSUE ANALYSIS. M. D. Hanisak, Harbor Branch Foundation, Ft. Pierce, FL., 32960, U. S. A.

Plant tissue analysis, a method commonly used to determine the nutritional status of agricultural plants, has been applied to seaweed ecology as part of a study on the physiological ecology of *Codium fragile*. The critical nitrogen concentration was determined to be 1.90% on a dry weight basis. Measurements of the internal nitrogen levels of thalli collected from three Rhode Island populations of *Codium* ranged from 0.75±0.08% to 3.72±0.08%. Internal nitrogen content varied seasonally, with a summer minimum and winter maximum, indicating nitrogen limitation during the summer and luxury consumption during the winter. Part of this luxury consumption appeared to support new growth in the spring. Plant tissue analysis is a potentially useful tool to predict the nutritional status of seaweeds.

54

ULTRASTRUCTURE OF THE FLAGELLAR APPARATUS OF *PLATYMONAS SUBCORDIFORMIS* (CHLOROPHYTA) AND A PROPOSED FUNCTION OF THE CONTRACTILE RHIZOPLAST. J. A. Swanson, J. L. Salisbury, and G. L. Floyd. Botany Dept., Ohio State University, Columbus, OH 43210, USA.

Details of the ultrastructure of the anterior end of *Platymonas subcordiformis* will be presented. Special attention will be given to the 3-dimensional relationship among the following structures: (1) the two massive roots (rhizoplasts) (2) the two minor roots (3) the four basal bodies and their associated flagella and (4) the apical depression or trough from which the flagella emerge. The geometric constraints of the deep apical depression limits the maximum degree of flagellar bend at their bases. We postulate that rhizoplast contraction may possibly act as a mechanical aid in (1) the initiation of the flagellar power-stroke and recovery-stroke (2) coordination of the stroke cycle and (3) directional control of planar flagellar beat. We further propose that tension developed during the flagellar power-stroke is involved in the extension of the rhizoplast and that the minor roots act as shock-absorbing structures.

55

ULTRASTRUCTURE OBSERVATIONS ON THE VEGETATIVE CELL CHLOROPLAST OF *HYDRURUS FOETIDUS* (CHRYSOPHYCEAE). R. A. Andersen, R. L. Meyer and K. S. Kim.¹ Department of Botany and Bacteriology and Department of Plant Pathology¹, University of Arkansas, Fayetteville, AR. 72701.

The posterior half of the *Hydrurus foetidus* vegetative cell contains a large cup-shaped plastid with finger-like projections which extend apically around the cell margin. The projections appear as isolated small, spherical chloroplasts when sectioned transversely, but when sectioned longitudinally they are continuous with the main body of the chloroplast. Unlike the typical chrysophyte chloroplast which has three thylakoids per lamellae, *Hydrurus foetidus* has lamellae composed of two thylakoids, and two or more lamellae may fuse to produce compound lamellae with thylakoids in multiples of two. A large pyrenoid is located in the center of the chloroplast and is traversed by paired thylakoids. Associated with the chloroplast is an elongate mitochondrion which lies in a groove that extends down one side, underneath and up the other side of the chloroplast.

56

THE OCCURRENCE OF FILAMENTOUS INCLUSIONS WITHIN THE VEGETATIVE CELL NUCLEUS OF *HYDRURUS FOETIDUS* (CHRYSOPHYCEAE). R. A. Andersen, K. S. Kim¹ and R. L. Meyer. Department of Botany and Bacteriology and Department of Plant Pathology¹, University of Arkansas, Fayetteville, AR. 72701.

Numerous filamentous inclusions were found within interphase nuclei in vegetative cells of *Hydrurus foetidus* collected from Alberta, Canada, and Montana, USA. The filamentous structures are from 20-30 μ m in diameter and occur either as a twisted, contorted cluster or a flattened sheet formed by folding back and forth. They are not found in the cytoplasm, are not associated with the nuclear envelope, nucleolus or chromatin and are not localized in any one region of the nucleus. The results of cytochemical investigations will be reported.

57

SUBCELLULAR LOCALIZATION OF HALOGENATED NATURAL PRODUCTS IN *LAURENCIA* (RHODOPHYTA). David N. Young, B. M. Howard, and W. Fenical. University of Southern California, Los Angeles, 90007, and Scripps Institution of Oceanography, La Jolla 92093.

Cells of many red algae contain unique and fascinating cytoplasmic and vacuolar inclusions. Certain of these algae also possess unusual, halogenated organic compounds. The possibility that certain inclusions may represent the morphological equivalent of the natural products was investigated in *Laurencia snyderae* Kylin (Rhodomelaceae, Ceramiales), a Pacific species containing bromoterpenes (snyderol) and a refractile, cytoplasmic inclusion, the corps en cerise. Results of x-ray fluorescence spectroscopy of thin sections of osmium-fixed tissue indicate high concentrations of Br in the corps en cerise in contrast to other cell contents. Analysis of unfixed ethanol-extracted tissue showed the absence of the corps en cerise and Br from the cortical cells. The presence of snyderol in the ethanol washes was confirmed by gas chromatography-mass spectroscopy. Such indirect evidence suggests the corps en cerise is composed, in part, of snyderol.

58

ULTRASTRUCTURE OF TETRASPOROGENESIS IN THE RED ALGA *PALMARIA PALMATA* (RHODYMENIA *PALMATA*). C.M. Pueschel, Cornell University, Ithaca, N.Y.

The tetrasporangium initial in *Palmaria palmata* arises from a cortex cell which enlarges and deposits around itself a protein-rich wall layer. This cell then undergoes mitosis to form a tetrasporocyte and a stalk cell. During prophase I of meiosis, cryptic synaptonemal complexes are present in the sporocyte nucleus. Also at this time, microbody-like structures become numerous between the nuclear envelope and a sheath of perinuclear ER. Clusters of non-membranous spherical structures also are associated with the nucleus. During diplotene the chromosomes decondense and the nuclear envelope becomes convoluted. An acid-polysaccharide mucilage formed by dictyosomes and ER is deposited around the meiocyte at this time. Following the nuclear divisions, sequential periclinal and anticlinal furrows cleave the meiocyte into four spores. After mucilage deposition ceases, the dictyosomes begin to produce vesicles which have glycoprotein-rich, electron-dense contents. These vesicles are abundant in escaping tetraspores, and it is likely that they contain adhesive material which aids in the attachment of the liberated spore.

59

COMPARATIVE ULTRASTRUCTURAL STUDIES OF MALE REPRODUCTIVE DIFFERENTIATION IN THE FLORIDEOPHYCEAE. J. Scott and D. Sigfred. Department of Biology, College of William and Mary, Williamsburg, VA. 23185, U.S.A.

The specialized male reproductive branches characteristic of many red algal species consist of numerous small cells formed by repeated divisions of a number of different cell types. These compact multicellular structures consequently are well suited for ultrastructural investigations of cell division. We have examined selected species from several families within the class Florideophyceae to determine if features of dividing cells are valid indicators of phylogenetic position. Our observations will be presented and discussed with regard to red algal systematics and the interrelationships of red algae with other primitive plant groups. In addition, we wish to call attention to observations of previously undisclosed ultrastructural features found in differentiating spermatangia and spermatia of several genera. Included among these observations are the presence of organized patterns of microtubules adjacent to the nuclear envelope and mitochondria-dictyosome associations in an unusual cup-shaped aggregation partially surrounding the nucleus.

60

ULTRASTRUCTURAL OBSERVATIONS OF SPERMATIAL DIFFERENTIATION IN *BANGIA* (RHODOPHYTA). K. Cole and R.G. Sheath. Department of Botany, University of British Columbia, Vancouver, Canada V6T 1W5.

The major organelles within cells of male *Bangia* filaments undergo a series of ultrastructural changes during production of spermatia. Initially, thylakoids within the large axial chloroplast develop a reticulate pattern commencing at the central pyrenoid region. Subsequent changes involve loss of lobes and diminution of volume through division; chloroplasts in final stages contain a few dilated, distorted thylakoids and many plastoglobuli. During differentiation the large nucleolus disappears from the nucleus and scattered masses of chromatin aggregate near the nuclear envelope. Furrows originating from the nuclear envelope-endoplasmic reticulum system isolate the chromatin masses and the nucleoplasm is eliminated. Several types of fibrillar vesicles are formed during the process and large Floridean starch reserves are utilized.

61

ULTRASTRUCTURE OF CELL DIVISION IN PORPHYRIDIUM.

K. Schornstein and J. Scott. Department of Biology, College of William and Mary, Williamsburg, VA. 23185, U.S.A.

Cell division has been examined by electron microscopy in *Porphyridium* isolate 637. Contrary to an earlier study (Bronchart and Demoulin, 1977), during the early division stages a spindle pole body similar to those seen in certain fungi is located at each pole in association with several organelles structurally resembling microbodies. An interzonal spindle composed of numerous microtubules extends across the cell at late anaphase. The nuclear envelope is intact except for polar fenestrations and perinuclear ER is absent. Cytokinesis occurs following the reorganization of the daughter nuclei. Spindle pole bodies and other cell division features of *Porphyridium* will be discussed and compared with other species of red algae recently examined in our laboratory.

64

ULTRASTRUCTURE OF SPERMATIZOIDS OF COLEOCHAETE SCUTATA. L.E. Graham. Department of Botany, University of Wisconsin-Madison, 53706, U.S.A.

Numerous thalli of *Coleochaete scutata* showing internal bands of developing and mature spermatozooids were collected in mid-July from the leaves of aquatic macrophytes. Fine structural studies revealed that mature spermatozooids were oval-shaped and that the cytoplasm and nuclear chromatin were highly condensed. The plastid was reduced in size, few thylakoids were present, and large starch grains had accumulated. The plasma-lemma of mature spermatozooids was covered with a layer of flattened body scales. The 2 flagella were covered with closely packed diamond-shaped scales and hairs. The cytoskeletal system consisted of a layer of microtubules (spline); about 35 microtubules were counted in one spline. A multi-layered structure (MLS) was associated with 2 basal bodies during earlier stages of spermatozoid development when flagella had not yet emerged, body scales were not present, and cytoplasm and chromatin were not condensed. The lower layers of the MLS may not persist in the mature spermatozoid. Comparisons with zoospores of *Coleochaete* and sperms of other green algae and archegoniate plants will be made.

62

ULTRASTRUCTURE OF MITOSIS AND CLEAVAGE IN TWO CHLOROSARCINACEAN ALGAE. T.R. Deason and K.W. Bullock. University of Alabama, 35486, U.S.A.

Friedmannia israelensis Chantanachat and Bold has uninucleate vegetative cells which form zoospores by successive bipartitions. The mitotic spindle is open and acentric. Basal bodies have not been found in cells with two or four nuclei, and probably do not appear until just before the last nuclear division. The basal bodies remain lateral to the spindle and are separated by the cleavage furrow which is evident at anaphase. No microtubules are associated with cleavage, but the nuclei lie close together after division.

Chlorosphaeropsis alveolata Herndon has multinucleate vegetative cells, but may undergo additional mitoses prior to cleavage to form zoospores. The spindle is closed, with basal bodies at the poles enclosed by the nuclear envelope at metaphase. Before cleavage, the nuclei moved toward the center of the cell and cleavage usually begins at the cell center. Microtubules lie parallel to advancing cleavage furrows and precede them.

Phylogenetic implications of these results will be discussed.

65

ON PITS AND PLASMODESMATA OF TRENTPOHLIALEAN ALGAE (CHLOROPHYTA). Dorothy F. Chappell. Wheaton College, 60187, U.S.A.

The Trentepohliaceae have been characterized in the past as having a central pit in the transverse walls. Electron microscopy has shown that the pit is a group of plasmodesmata rather than a single large plug like that of red algae. However, a cultured species of *Cephaleuros* with narrow filaments and narrow transverse walls has plasmodesmata occupying nearly the entire transverse wall. Collected *Cephaleuros* spp. found on the leaves of *Magnolia* and other woody genera have wider transverse walls with plasmodesmata centrally located in a pit. A cultured species of *Trentepohlia* with cell width intermediate between the two types of *Cephaleuros* has plasmodesmata centrally located in a pit, but the pit occupies a large portion of the transverse wall. It is concluded that the Trentepohliales can be characterized as possessing a centrally located group of plasmodesmata, but they are clearly seen as such only in wider cells where the transverse wall extends sufficiently beyond the central region. Some taxonomic, developmental, and phylogenetic problems will be discussed.

63

ULTRASTRUCTURE OF THE ZOOSPORES OF FASCICULOCHLORIS BOLDII AND PLANOPHILA TERRESTRIS (CHLOROPHYCEAE). K.W. Bullock and T.R. Deason. The University of Alabama, 35486, U.S.A.

Zoospore ultrastructure was examined in two coccoid green algae which possess glycolate oxidase, *Fasciculochloris boldii* and *Planophila terrestris*. Zoospores of *Fasciculochloris boldii* are biflagellate, possess a cell wall and are characterized by a cruciate arrangement of the microtubule rootlets in a 4,2,4,2 pattern. The zoospores of *Planophila terrestris* are quadriflagellate, naked and have a cruciate microtubule rootlet arrangement in a 5,2,5,2 pattern. Additionally, zoospores of *Planophila* often settle down by losing the flagella and developing a cell wall, but they retain the contractile vacuole and the basal body-microtubule rootlet complex.

The taxonomic and phylogenetic implications of these results will be discussed.

66

ULTRASTRUCTURE OF THE EGG CELLS OF VOLVOX CARTERI F. WEISMANNIA. R. Bircham. School of Forest Resources, University of Georgia, Athens, Georgia 30602.

The female strain of *Volvox carteri* f. *weismannia*, a freshwater green alga, forms egg cells when the hormone-like inducing substance produced by the male strain is present. About 12 to 20 egg cells are formed within the female colony. The morphology of the cells was studied by light and electron microscopy. The cells are biflagellate but are non-motile and the flagella do not extend through the sheath of the parent colony. Structural differences are observed in the flagella when they are compared with the flagella of the somatic cells and the androgonidia (male reproductive cells). The flagellar membrane is convoluted and the central pair of microtubules is displaced to one side. Egg cells have a highly-lobed chloroplast with an extensive lamellar system and numerous groups of 10 to 40 striated chloroplast tubules. Vesicles and extensions of smooth endoplasmic reticulum containing flocculent material are observed near the chloroplast. The nucleus has a prominent nucleolus and accessory nucleoli. An extensive Golgi apparatus surrounds the nucleus.

67

SYMBIOSIS AND DIGESTION IN THE CILIATE PROTOZOAN

OPHRYDIUM VERSATILE (O.P.M.). L.J. Goff and J.R. Stein, Center for Coastal Marine Studies, University of California, Santa Cruz, 95064 and Botany Department, University of British Columbia, Vancouver, Canada.

Green algal endosymbionts, morphologically similar to the genus *Chlorella*, occur within perialgal vacuoles in colonial (zooid) and migratory (telotroch) stages of the peritrich *O. versatile*. Within the colonial stage, algal cells divide to form autospores. Frequently more than 1,500 cells occur in each mature zooid. Degenerating algal cells in food vacuoles are observed infrequently, suggesting that the zooid/algal association is stable. Far fewer algal cells (ca. 300) occur in the migratory telotroch. This stage is formed when the zooid contracts, breaks out of its lorica and swims away from its attachment stalk. During migration the telotroch ceases to feed on external food particles and digests a significant number of its endosymbionts. Digestion results when the perialgal vacuoles coalesce with food vacuoles or when ER-derived membrane-bound cupulae (primary lysosomes) coalesce with perialgal vacuoles. After migration, the telotroch settles forming a new zooid and division of the endosymbiont resumes.

68

THE STRUCTURE AND DISTRIBUTION OF SURFACES IN THERMOPHILIC BLUE-GREEN ALGAL/BACTERIAL MATS. W. R. Fagerberg and H. J. Arnett. Biology Department, The University of Texas at Arlington, Arlington, TX 76019, U.S.A.

TEM and SEM studies of blue-green algal/bacterial mats growing under diverse conditions have provided valuable insights into the structure of these communities. Among other important features, mat structure involves several kinds of surfaces which appear to be essential in its development and function. These surfaces represent boundaries or interfaces between the mat organisms and other components of the environment. The surfaces include not only the external surfaces which interface with water, soil or air, but also internal surfaces formed in relation to bubbles, rocks, leaves and other debris. The presence of bubbles with their associated air-organism interface may form a major portion of the mat volume. Bubble formation is especially important in mat communities which develop in slow or static waterflow systems. In some cases the formation of new mats appears to be dependent on bubble formation. The final 3-dimensional structure of the mats is, in part, determined by its "bubble content."

69

MICROCOLONY STRUCTURE IN THERMOPHILIC BLUE-GREEN ALGAL/BACTERIAL MATS. H. J. Arnett and W. R. Fagerberg. Biology Department, The University of Texas at Arlington, TX 76019, U.S.A.

The internal structure of several types of blue-green algal/bacterial mats has been studied by SEM and TEM techniques. In addition to stratification, which has been well recognized in similar systems, these mats exhibit microcolonies which also appear to be important structural features. This report will discuss two basic kinds of microcolonies; the first can often be described as a small sphere or irregularly shaped area embedded in the mat. In these areas there is a local buildup of one or a set of species which results in substantial increase in organismal density. These colonies can sometimes be recognized in the light microscope because of their color difference as well as their increased density. The colonies appear to develop by a localized relative increase in cell proliferation. A second type of colony develops by the use of algal sheaths as a substrate for growth of other algae or bacteria. Sometimes this colonization involves the metabolic utilization of algal products, and at other times it may involve only passive attachment.

70

FACTORS REGULATING THE RATES OF RELEASE AND ENTRY OF ORGANIC COMPOUNDS BY ALGAL CELLS. Johan A. Hellebust. Department of Botany, University of Toronto, Toronto, Ontario M5S 1A1, Canada.

Algal cells are considered chiefly as producers of dissolved organic substances in aquatic ecosystems. For the majority of photoautotrophic planktonic algae this is probably true. However, many algal species possess inducible or constitutive transport systems for organic substrates, and one must, therefore, consider at least some of the algal species as potential consumers of dissolved organic substances. The nature of algal extracellular substances will be examined, and particular stress will be made on how environmental and physiological factors determine both the quantitative and qualitative aspects of algal excretion. Furthermore, some of the problems involved in obtaining reliable data on these phenomena will be considered.

The significance of the presence of complex transport systems for organic substrates in algal cells will be discussed in relation to the presence of such substrates in the natural environment.

71

SIGNIFICANCE OF ALGAL EXTRACELLULAR PRODUCTS TO BACTERIA IN LAKES AND CULTURES. C. Nalewajko, Life Sci. Div., Scarborough College, Univ. of Toronto, West Hill, Ont., Canada.

In mixed algal-bacterial cultures, bacteria grow at the expense of algal extracellular products, drastically reducing levels of DOM and selectively utilizing some substances. The lag usually observed in utilization of ^{14}C labelled algal extracellular products by bacteria may allow measurement of true or "gross", as opposed to apparent or "net", excretion rates.

Simulated diurnal experiments with *Chlorella-Pseudomonas* cultures showed that bacterial numbers and cell size increased following a pulse of extracellular products. Concentrations of glycolate were controlled by bacteria. Similar relationships were apparent in some diurnal studies with lakewater. Fractionation of populations on 30 μ , 8 μ , 1 μ , and 0.2 μ filters after incubation with ^{14}C -bicarbonate and ^{14}C organics permitted separate assessments of algal and bacterial metabolic activity.

During a 17 month period, glycolate concentrations in L. St. George ranged from 36 to 359 $\mu\text{g l}^{-1}$. Values increased both during declining and developing algal blooms. Bacterial numbers were positively correlated with primary production and, at times with glycolate concentrations.

72

BACTERIOPLANKTON: NATURE, BIOMASS, ACTIVITY AND RELATIONSHIPS TO THE PROTIST PLANKTON. J. McN. Sieburth, University of Rhode Island, 02881, U.S.A.

Epifluorescence microscopy indicates that the bacteria on seston (epibacteria) are minor compared to those free in the water. Electron microscopy of concentrates passing 2 μm Nuclepore membranes shows a three-component bacterioplankton with the large epibacteria occurring free as transients in shallow waters, a large population of diverse small bacteria (0.3 μm wide) growing on dissolved organic matter above threshold concentrations that is only rivaled in the open sea by the ubiquitous chroococcoid cyanobacteria that contribute to the phototrophic biomass. ATP assays of selectively filtered bacterioplankton account for some 30% of the total microbial biomass, agree with epifluorescence counts, and in diffusion culture account for the uptake of released DOC. An appreciable P.M. pulse of carbohydrate is associated with chlorophyll a impoverished ATP >3 μm , suggestive of nitrogen-limited phytoplankton and accumulations of protozooplankton.

73

BACTERIAL-ALGAL NUTRIENT CYCLING IN THE GREAT SALT LAKE, UTAH. F.J. Post, J.C. Stube and D.B. Porcella. Departments of Biology and Civil Engineering, Utah State University, Logan, Utah 84322

The Great Salt Lake, Utah north arm is extremely dense with a dissolved solids content of about 360 g l^{-1} . It is populated by several species of the algal genus *Dunaliella* and a large population of extremely halophilic bacteria. Nutrient levels are high in organic carbon (44 mg l^{-1} as C) and nitrogen (6 mg l^{-1} as N) with a C/N ratio of about 7:1. Nitrate has not been encountered in the north arm and ammonia infrequently. Laboratory microcosms indicate an algal preference for ammonia as opposed to nitrate with a later increase in bacterial numbers. Glutamate stimulated only the bacteria while urea had little effect. Analysis of evolved gases showed production of oxygen, methane, ethane, ethylene, propane and one unknown hydrocarbon. Final biomass determination indicated greater bacterial biomass than algal biomass in all columns, a situation also found in the lake itself.

74

A. *ZOOGLLOEA* SP. IN OBLIGATE ASSOCIATION WITH BLOOMS OF *ANABAENA FLOS-AQUAE*. D.E. Caldwell and S.J. Caldwell. University of New Mexico, Albuquerque, N.M. 87131, U.S.A.

A flagellated, Gram-negative rod was isolated from a bloom of *Anabaena flos-aquae*. The isolate was numerically dominant *in situ* during the bloom and was located within the microenvironment of cyanobacterial mucilage. Recent cultural and biochemical studies have shown that the isolate is probably a new species in the genus *Zoogloea*. The proposed species designation is cyanophila. Several plating media were devised and compared. One of these was used to reisolate the *Zoogloea* sp. during the summer of 1978 from another bloom of *Anabaena flos-aquae* in which it was again the numerically dominant bacterium present. The life cycle of the bacterium has been determined and studies of the effect of the blue-green bacterial association on productivity measurements are in progress. The bacterium was unable to grow in liquid media and required either solid media or cyanobacterial mucilage.

75

CARBON AND PHOSPHORUS ASSIMILATION BY PHYTOPLANKTON AND BACTERIA IN THE RHODE RIVER ESTUARY. M.A. Faust, N.M. Goff and J.J. Miklas. CBCEs, Smithsonian Institution, Edgewater, MD 21037. U.S.A.

The assimilation of inorganic carbon (C) and phosphorus (P) by plankton in an estuarine environment has been estimated by double isotope labeling and micro autoradiography. Assimilation of C and P by algae from that of bacteria was separated by using gentamicin, a broad spectrum antibiotic, which inhibits bacteria activity and 3-(3, 4-dichlorophenyl)-1, 1-dimethyl urea (DCMU) inhibitor of photophosphorylation. The effects of inhibitors on C and P-assimilation of phytoplankton and bacteria varied with the inhibitor, nutrient and experimental procedure used. The effects of inhibitors on total C and P-uptake of plankton are compared with the metabolic activity (grain counts) of *Prorocentrum mariae lebouriae*, a numerically dominant species and planktonic bacteria. This study indicates the possibility of a differential C and P assimilation process of estuarine plankton.

76

ISOLATION OF INTACT GOLGI APPARATUS FROM *EUGLENA GRACILIS*. R.E. Triemer and M.A. Gillott. Department of Botany, Rutgers University, New Brunswick, New Jersey 08903

A method for the isolation of intact golgi from a unicellular alga is described. Cells of *Euglena gracilis* contain an extensive golgi network. The individual dictyosomes are large, commonly containing ten to twenty cisternae. Log phase cells are broken in a French pressure cell at 2,000 psi in a breaking mix containing sucrose, sorbitol and ficoll. Addition of low concentration of glutaraldehyde or formaldehyde to the breaking mix increases the numbers of stacked cisternae present in the final preparation. In addition to golgi stacks, the fractions contain numerous smooth vesicles. Swollen cisternae, which are also present may account for these vesicles. Three golgi fractions are obtained by centrifugation in a discontinuous sucrose gradient. Fractions differ morphologically in the degree of stacking of cisternae. Golgi fractions are identified by cytochemical tests.

77

COMPARATIVE ULTRASTRUCTURE OF THE VEGETATIVE CELLS OF SELECTED MARINE CHAETOPHORACEAE (CHLOROPHYTA). G. L. Floyd and C. Yarish. Ohio State University, 43210, and University of Connecticut, Stamford, 06903.

Several species of the marine Chaetophoraceae have recently been shown to demonstrate considerable morphological plasticity. In the present study, eight species of this group were examined for several ultrastructural features of the vegetative cell. All isolates lack plasmodesmata. Mitochondria contain notably long and wide cristae. Pyrenoids are often traversed by a single thylakoid. Classification based on cytological characteristics has been shown to be more reliable than growth habit. On the basis of ultrastructural features, it seems probable that many of these marine algae should be included in the Ulvales. In addition, an SEM survey of the thalli will be presented.

78

CHLOROKYBUS ATMOPHYTICUS GEITLER, A CHLOROSARCINOID CHAROPHYTE. Catherine E. Rogers, Karl R. Mattox and Kenneth D. Stewart. Department of Botany, Miami University, Oxford, Ohio, 45056, U.S.A.

The zoospores of *Chlorokybus atmophyticus* have typical charophycean features as follows: (1) external and internal asymmetry with laterally attached flagella, (2) body and flagellar scales, (3) a flagellar apparatus with a single broad band of descending microtubules, the anterior portion of which is associated with another structure in an arrangement generally referred to as a "multilayered structure" (MLS), and (4) a single microbody attached to the flagellar apparatus close to the basal bodies.

Chlorokybus atmophyticus is presently the simplest known charophyte, unless it becomes clear that certain unicellular, scaly green flagellates should also be assigned to the class. The chlorosarcinoid habit of *Chlorokybus atmophyticus* indicates that that mode of growth evolved independently in the Charophyceae and Chlorophyceae.

79

ASSOCIATION OF DINOFLAGELLATE SYMBIONTS WITH GASTRODERMAL TISSUE OF THE SEA ANEMONE, *AIPTASIA*. W.V. Glider, D.W. Phipps, Jr., and R.L. Pardy. School of Life Sciences, University of Nebraska, Lincoln, 68588, U.S.A.

Algal-invertebrate symbioses are prevalent in the marine environment. Dinoflagellates, historically called zooxanthellae, are the most commonly encountered marine algal symbionts. Research was conducted on the dinoflagellate associated with the sea anemone *Aiptasia pallida* Verrill. Most zooxanthellae associated with sea anemones are thought to be located within the cells of the host animal, although published light and electron micrographs do not appear to fully substantiate this claim. In an attempt to resolve this question, *A. pallida* was investigated using light and scanning electron microscopy. Both symbiotic and aposymbiotic (algal-free) animals were studied. Intact pieces of tissue as well as enzymatically macerated tentacle tissue were analyzed to determine the location of the symbiotic alga. The technique of stereomicroscopy was used to enhance the information content of the SEM micrographs. Our observations support an intracellular location for the algal symbionts.

80

COMPARISON OF TWO SPECIES OF *VIDALIA* (AMANSIEAE, RHODOMELACEAE). M. H. Hommersand, University of North Carolina, Chapel Hill, N. C. 27514, U.S.A.

Two species placed in the genus *Vidalia* are compared. One of these, *V. colensoi* from New Zealand is closely related to the type species, *V. spiralis*, from Australia. The other, *V. obtusiloba*, is found in tropical Atlantic North and South America. *Vidalia obtusiloba* is repeatedly branched endogenously in an alternating pattern from every fourth segment; trichoblasts are normally present on vegetative tips; the wing cells are conspicuous and prismatic, and the reproductive organs are normally borne on ordinary endogenous branches. In *V. colensoi* endogenous branches are produced alternately from every third segment and are strictly determinate ending in short spines; indeterminate branching is adventitious from the midrib; trichoblasts are absent from the vegetative tips; wing cells are inconspicuous covered by a thick cortex, and reproductive organs are found exclusively on determinate adventitious branches. The ontogeny of trichoblasts, pericentral cells, wing cells, cortical cells, branch initials and reproductive structures are described and analyzed, for the two species in comparison with similar stages in other genera of Amansieae.

81

SYSTEMATIC STUDIES OF *ECTOCARPUS SILICULOSUS* VAR. *DIVERGENS* (KORNHANN) COMB. NOV. AND *GIFFORDIA PEDICELLATA*, SP. NOV. (PHAEOPHYCEAE). L.A. Pocratsky and R.G. Rhodes. University of Tennessee, Knoxville, 37916, and Southwest Missouri State University, Springfield, 65802, U.S.A.

Ectocarpus siliculosus var. *divergens* (Kornmann) comb. nov. and *Giffordia pedicellata*, sp. nov. were collected from an intertidal salt marsh in Virginia. Both are new records for North America. Plants collected and originally identified as *Ectocarpus divergens* (Kornmann) were reassigned to the species *Ectocarpus siliculosus* var. *divergens*. Morphological studies indicated that there was not enough evidence to support the retention of *Ectocarpus divergens* as a species since it was indistinct from *Ectocarpus siliculosus* at various stages in its life history. A direct, asexual life history was observed for this plant, with swimmers from the plurilocular sporangia producing successive generations of similar plants. A new species of *Giffordia*, *Giffordia pedicellata*, was created to encompass a taxon of the genus which did not conform to any established species descriptions. Distinguishing characteristics were the frequent occurrence of stalked sporangia and an unusual alternation between two morphologically distinct forms of the plant.

82

DISCOVERY OF A FREE-LIVING ZOOXANTHELLA. Alfred R. Loeblich, III and James L. Sherley. Department of Biology, Harvard University, Cambridge, Massachusetts, 02138, U.S.A.

We have isolated a marine, free-living dinoflagellate that is congeneric with zooxanthellae. Zooxanthellae have recently been considered to belong to the genus *Gymnodinium* because other investigators believe the motile phase of these organisms lacks thecal plates. The cell coverings of the motile and nonmotile cells of our free-living isolate were compared to those from a zooxanthella isolated from the coelenterate *Cassiopeia*. By coupling light/dark synchronization and transmission and scanning electron microscopy, we have demonstrated the presence of thecal plates arranged in a very similar pattern on both our isolate and the *Cassiopeia* symbiont. The presence of thecal plates indicates that these marine isolates do not belong to the genus *Gymnodinium*. Our discovery of a free-living zooxanthella supports the belief that other zooxanthellae can also exist in a free-living state.

83

SCANNING ELECTRON MICROSCOPICAL OBSERVATIONS IN THE GENUS *VAUCHERIA* (XANTHOPHYCEAE). Donald W. Ott, Department of Biology, The University of Akron, Akron, Ohio 44325.

Scanning electron microscopy was used to investigate antheridial and other surface structures of various species of *Vaucheria* in an attempt to elucidate the taxonomic criteria of the various sections of the genus.

84

INTERPRETATION OF ZYGOSPORE-WALL STRUCTURE IN RELATION TO THE SYSTEMATICS OF THE ZYGNEMATACEAE. Robert W. Hoshaw. Department of Ecology and Evolutionary Biology. University of Arizona, Tucson, 85721, U.S.A.

Taxonomic keys in existing monographs of the Zygnemataceae (*Spirogyra* and relatives) require knowing the number of walls surrounding the zygospore and whether any of these are sculptured or ornamented. Thus, investigations were conducted to test the reliability of zygospore wall number and ornamentation as taxonomic criteria. Zygospore walls of 9 species of *Sirogonium*, from unialgal cultures or from glycerine-preserved material in the collection of E. N. Transeau, were separated or removed with surgical blades using a stereomicroscope. Counts of walls were possible but ornamentation on median walls was not seen clearly. Scanning and transmission electron microscopy revealed that median zygospore walls previously described as single are double and median walls described as smooth are ornamented. Median walls of *S. floridanum*, *S. sticticum*, and *S. tenuis* show ornamentation, although described as smooth. Zygospore wall number and ornamentation will be discussed in relation to prevailing descriptions of species, taxonomic keys, and phylogenies.

85

ON THE DEVELOPMENT OF THE CARPOSPOROPHYTE IN *SOLIERIA TENERA* (AGARTINALES) AND THE NOMENCLATURE STATUS OF *NEO-AGARDHIELLA*. G.F. Papenfuss and E.K. Ganesan. University of California, Berkeley, 94720, U.S.A. and Universidad de Oriente, Cumaná, Venezuela.

Solieria tenera (J. Agardh) Wynne et Taylor has a 3-celled carpogonial branch and is non-procarpic, the auxiliary cell being produced in a separate branch system, spatially removed from the carpogonial branch. Connection between the fertilized carpogonium and the auxiliary cell is effected by a long, slender connecting filament, which issues from the distal end or the side of the carpogonium. Following diploidization, the auxiliary cell cuts off a gonimoblast initial toward the inside of the thallus. Later, the auxiliary cell fuses with neighboring cells, probably including some of the first-formed gonimoblast cells. The mature cystocarp contains a large fusion cell, from the periphery of which gonimoblast filaments radiate, the terminal cells of which become carposporangia.

The nomenclature of the related genus *Neogardhiella* Wynne et Taylor is discussed. It is pointed out that this is a superfluous name for *Agardhiella* Schmitz.

86

A PRELIMINARY REPORT OF THE FRESH-WATER PHAEOPHYTE, *SPHACELARIA FLUVIATILIS* (JAO) Peter Timpano. The University of Kansas, Lawrence, Kansas 66045.

Since the first description of *Sphacelaria fluviatilis* by Jao (1943) and its subsequent report for the western hemisphere by Thompson (1975), no further studies on this alga have been reported. *S. fluviatilis* is the only known representative of the order Sphacelariales to occur in a fresh-water environment. Like the other freshwater Ectocarpales species, its life history is not completely known. Collections from the type location for the North American report have been made. The alga was isolated and unialgal cultures are now maintained. At the present time, both morphological and cytological data are being collected. The current study will hopefully produce the first report of a life history of a fresh-water brown alga.

87

FEULGEN MICROSPECTROPHOTOMETRIC STUDIES OF GREEN FLAGELLATES (VOLVOCALES). A.W. Coleman. Brown University, 02912, U.S.A.

Two types of problems have been examined using Feulgen microspectrophotometry. Diversity of chromosome numbers within species and comparison of karyotypes among clones with different chromosome complements suggested that increased chromosome number might only represent a different distribution of the same total chromatin mass/cell. Microspectrophotometric studies show that one cannot distinguish among haploid *Pandorina morum* clones with 2, 5, or 12 chromosomes, but all three can be distinguished from a known diploid hybrid.

The timing of DNA replication at the time of daughter cell production was examined in the same manner. In *Pandorina*, *Volvox carteri*, and *Chlamydomonas reinhardtii*, nuclei at early divisions cannot be distinguished from nuclei in the final divisions by DNA content. This agrees with the report of Lee and Kemp (1975) on *Eudorina*, and suggests that neither polyploidy nor polyploidy occurs in the normal cell cycle of the Volvocales. Work made possible through the hospitality of the Institute of Med. Cell Res. and Genetics of the Karolinska Institute.

88

CHARACIOCHLORIS AND CHARACIOSIPHON. R.H. Thompson, Dept. Botany, The Univ. of Kansas, Lawrence, Kansas, 66045.

The isolation of *Characiochloris characioides*, the type species of the genus, from local waters at Lawrence, Kansas is reported. The alga was found to become multicellular, each cell containing a parietal plastid, radially reticulate and fissured, with a central pyrenoid, a nucleus, two or more contractile vacuoles and a plasmalemma which ultimately secretes a very delicate sheath. The cells remain interconnected by cytoplasmic strands and compacted as a parenchymoid mass, the whole enclosed by the greatly expanded sheath inherited from the zoospore. It is shown that *Characiochloris* has the same morphological characters as *Characiosiphon*, differing only in its compact cellularity as opposed to the cellular dispersion in the saccate plant body of *Characiosiphon*. The genus *Characiochloris* is emended to include the newly discovered features and is transferred to the Characiosiphonaceae of the Characiosiphonales.

89

ULTRASTRUCTURE OF *ANABAENA VARIABILIS* MUTANTS WITH AN ALTERED HETEROCYST DIFFERENTIATION. N.J. Lang and J.F. Haury. University of California, Davis, 95616, U.S.A.

Mutants of *Anabaena variabilis* unable to grow without inorganic fixed nitrogen produce morphologically aberrant heterocysts detectable via light microscopy. The ultrastructure of vegetative cells and heterocysts was compared in the mutants and wild-type after fixation with glutaraldehyde followed by either OsO₄ or KMnO₄. Parallel studies showed no acetylene reduction in all mutants and no heterocyst-specific glycolipids in some. In the latter the laminated layer of the heterocyst envelope known to be comprised of glycolipid is not demonstrable. Polar granules when present in mutant heterocysts lack the typical electron opacity and "structured" aspect. Some mutant heterocysts contain thylakoids which appear especially disorganized and fragmented toward the poles. The observations indicate that in heterocysts of these chemically induced mutants, the loss of nitrogen fixation competence is accompanied by several ultrastructural anomalies not visible with light microscopy. A correlation between altered structure and an inability to fix N₂ is thus suggested but is not directly proved.

90

VARIATIONS IN FRUSTULE ULTRASTRUCTURE OF SOME MASTOGLOIA SPECIES (BACILLARIOPHYCEAE) FROM A FLORIDA LAGOON. F. C. Stephens and R. A. Gibson. Harbor Branch Foundation, Inc., 33450, U. S. A.

Three types of valve face construction were observed in eleven species of *Mastogloia* Thw. ex Wm. Smith from the Indian River lagoon, Florida. *Mastogloia binotata* (Grun.) Cl., *M. crucicula* (Grun.) Cl., *M. ovalis* A.S., *M. erythraea* Grun. and *M. cyclops* Voigt are simply constructed, without silicious ribs; *M. pusilla* (Grun.) Cl., *M. pumila* (Grun.) Cl. and *M. schmidtii* Heiden have silicious ribs on the internal valve face. The third type observed in *M. angulata* Lewis, *M. cribrata* Grun. and *M. fimbriata* (Brightw.) Cl. have such ribs only on the margins of the internal valve face. A relationship between locular pore position and valve outline was also observed. The pores of elliptical valves penetrate the intercalary band opposite their respective locules; those of lanceolate valves are slightly displaced toward the valve apices.

91

COMPARATIVE ULTRASTRUCTURE OF TWO MARINE EPIZOIC DIATOMS (BACILLARIOPHYCEAE: PROTORAPHIDACEAE). R.A. Gibson. Harbor Branch Foundation, Inc., 33450, U.S.A.

Pseudohimantidium pacificum and *Protoraphis* sp. are epizoid diatoms in the family Protoraphidaceae. Both have narrow axial areas on their valve faces, recurved on at least one valve end and connected to external grooves at either apices. The grooves on *P. pacificum* are oriented more or less parallel to the apical axis whereas those on *Protoraphis* sp. are parallel to the transapical axis. The grooves on *P. pacificum* are partially occluded internally by a row of labiate processes; the grooves on *Protoraphis* sp. are partially occluded by a plicate silicious band. In both diatoms mucilaginous stalk material is extruded from apical mantle slit fields. The stalk of *P. pacificum* is frequently dichotomously branched but not observed branched at all in *Protoraphis* sp. Cells of *P. pacificum* were not observed directly connected to each other whereas this was frequently the case in *Protoraphis* sp.

92

THE BIOLOGY OF *LOBOCOLAX DEFORMANS* HOWE. Allan E. Gluck and Lynda J. Goff, Department of Biology, University of South Florida, Tampa, FL 33620 and Division of Natural Science, University of California, Santa Cruz, Ca. 95064, U.S.A.

Lobocolax deformans Howe is a growth described as a parasite of *Prionitis*. Recent studies, however, indicate that the growth is a gall rather than separate organism. What has been found is that the protuberance occurs throughout the morphological and geographical range of the host; the growth has no differentiation of structure; cells are highly irregular in shape and internal structure; and that bacteria are found within localized areas between the cells of the growth (but not in normal host tissue).

93

PRODUCTION OF A CELL FUSION HORMONE, RHODOMORPHIN, BY *GRIFFITHSIA TENUIS* (RHODOPHYTA). Susan D. Waaland. University of Washington, Seattle, WA. 98195

The process of cell repair by cell fusion, between a rhizoid and a rhizoid-like repair shoot, has been studied, in vivo, in the filamentous, marine red alga, *Griffithsia pacifica*. Indirect evidence indicated that this process was coordinated by a morphogenetic call fusion hormone which is produced by the repair rhizoid and which induces the formation of, sustains the rhizoid-like growth of, and attracts the repair shoot for fusion. Using another species in this genus, *Griffithsia tenuis*, I have been able to obtain more direct evidence for this hormone, rhodomorphin. An in vitro assay for hormone production has been developed; one can show that rhodomorphin is produced by rhizoids, but not by shoot cells, and that it can induce freshly decapitated filaments to produce rhizoid-like repair shoots. If intercalary filaments are excised, they regenerate new rhizoids within 4.5 hrs; production of the hormone is initiated at 1.5-2 hrs after induction of rhizoid regeneration and continues as long as the rhizoid is growing. It is possible to obtain large quantities of biologically active hormone solution and preliminary purification has begun.

94

A COMPARATIVE STUDY OF THE CELL WALLS OF SELECTED GREEN ALGAE. D. S. Domozych, K. R. Mattox and K. D. Stewart. Department of Botany, Miami University, Oxford, Ohio, 45056, U.S.A.

Chemical analyses of purified cell wall fractions of the following green algae have been performed: *Klebsormidium flaccidum*, *Ulothrix belkiae*, *Pleurastrum terrestre*, and *Pseudendoclonium basiliense*. In each alga, the wall contains varying amounts of protein. SDS gel electrophoresis studies show that each wall possesses a high molecular weight glycoprotein which separates into five or six bands. Hydroxyproline is present in ranges from 0.2 to 0.3% of the wall. Selective solvent hydrolysis and chromatography reveals patterns of polysaccharide content. Walls of *Klebsormidium* have low cellulose and high water-soluble polysaccharide ratios, while the walls of *Pseudendoclonium* have constituents similar to the *Ulva lactuca* type. Walls of *Pleurastrum* and *Ulothrix* are comparable in percentage analyses.

95

SELECTED AREA ELECTRON DIFFRACTION: A TECHNIQUE FOR COMPARATIVE CELL WALL STUDIES IN THE CHLOROPHYTA. David S. Domozych, Dept. of Botany, and Joseph S. Cantrall, Dept. of Chemistry, Miami University, Oxford, Ohio, 45056, U.S.A.

Selected area electron diffraction patterns have been performed on the walls of *Platymonas subcordiformis*, *Pyramimonas orientalis*, *Ulothrix belkiae*, *Klebsormidium flaccidum*, *Pleurastrum terrestre*, *Pseudendoclonium basiliense* and *Coleochaete nitellorum*. Cleansed walls have been obtained by means of pressure cell application, sonication, and selective chemical hydrolysis. Both unstained and phosphotungstate stained dried wall preparations have been utilized in the study. Crystalline periodic distances in the range of 0.4 to 1.2 nm have been observed using gold foil as a calibration standard. The technique of obtaining these diffraction patterns will be described with some preliminary interpretation of the periodic distance found. Correlations between diffraction patterns and other ultrastructural data of the walls will be similarly presented.

96

DNA MEASUREMENT IN EUDORINA USING QUANTITATIVE FLUORESCENT MICROSCOPY. C. L. Kemp, Simon Fraser University, Burnaby, Canada, V5A 1S6

Quantitative estimations of DNA content in many algae have proven difficult to obtain because of low DNA amounts and small nuclear size. Using *E. elegans* and *E. californica*, a comparison of the relative DNA levels obtained by the Feulgen and BAO fluorescent technique was made. These studies showed the ease and rapidity of the fluorescent technique. In addition, the BAO fluorescent technique confirmed the pattern of DNA synthesis found for *E. elegans* and *E. californica* by the Feulgen technique.

97

PHYTOFLAGELLATES: AN OVERVIEW. E.R. Cox. Texas A&M University, 77843. U.S.A.

An attempt will be made in this presentation to provide introductory information about the six groups of phytoflagellates discussed in this Symposium - the Prasinophytes, the Chloromonads, the Euglenoids, the Coccolithophorids, the Silicoflagellates and the Dinoflagellates. Background data from previous systematic and evolutionary studies will be discussed to inform the listeners of basic similarities and dissimilarities in these groups of algae and to challenge them with certain unresolved problems.

98

PRASINOPHYTE FLAGELLATES: A REVIEW OF CELL FORM AND FUNCTION. Richard E. Norris. Dept. of Botany & Friday Harbor Labs, University of Washington, Friday Harbor, WA 98250, U.S.A.

Genera of prasinophyte flagellates will be reviewed giving details of our present day knowledge on fine structure and function of organelles. Particular attention will be given to 1) a review of general cell form in prasinophyte flagellates; 2) a comparison of scale form among the different genera; 3) patterns of behavior among the different genera and species; 4) structure of the basal body apparatus and the microtubular "skeleton"; 5) hypotheses on scale deposition on cell membranes; 6) variations in form of chloroplasts and their pyrenoids; and 7) nuclear and cell division cycles that are known. The discussion will emphasize areas where additional investigations may prove to be especially important to our understanding of prasinophyte form, organelle function, and systematics.

99

CHLOROMONADS - FORM AND FUNCTION. Peter Heywood. Division of Biology and Medicine, Brown University, Providence, Rhode Island 02912, U.S.A.

Most ultrastructural information on the Chloromonads has been obtained from *Gonyostomum semen* and *Vacuolaria virescens*. These large biflagellate unicells have been maintained in laboratory cultures. Chloroplasts are present in large numbers and contain chlorophylls a and c. Chloroplast bands consist of 3 apposed thylakoids; external to the girdle band is a chloroplast envelope and endoplasmic reticulum. Mitochondria are small, unbranched structures with tubular cristae. The osmoregulatory apparatus consists of a contractile vacuole and an adjacent Golgi apparatus. These structures occur above the anterior surface of the interphase nucleus and are associated with the poles during mitosis. The anterior flagellum bears tubular flagellar hairs that originate in the endoplasmic reticulum. A portion of the flagellar root system connects the flagellar bases to the anterior surface of the nucleus.

The systematic affinities of the Chloromonads will be discussed in relation to these findings.

100

EUGLENOID FLAGELLATES: SELECTED FEATURES OF FORM AND FUNCTION. Patricia L. Walne. University of Tennessee, Knoxville, 37916. U.S.A.

A variety of rather well-defined diagnostic features characterize the euglenoid flagellates, but despite their basic similarity, they manifest a considerable diversity in form and function that poses intriguing systematic and phylogenetic problems at nearly every taxonomic level. Among the traditional criteria used to infer relationships, flagellar number and arrangement, together with pellicle structure and elasticity, the presence of envelopes (loricae), cell shape, and type of symmetry have been proposed by Leedale (1967) as the basic indicators of phylogenetic trends in these organisms. Certain organelles, such as chloroplasts and eyespots and their related functions are also important in any consideration of euglenoid systematics. Comparative data from ultrastructural and physiological studies of selected species of *Euglena* and *Trachelomonas* will be considered, with particular emphasis on characterization of such special features as eyespots and envelopes. New data on eyespot pigments and on envelope microarchitecture and chemical composition will be evaluated in terms of their possible functional roles and postulated phylogenetic implications.

101

COCCOLITHOPHORES: THEIR EVOLUTION THROUGH TIME. S. Gartner. Dept. Oceanography, Texas A&M University, 77843 USA.

The earliest unequivocal fossil coccoliths first appear in the geological record some 180 million years ago and have many ultrastructural features in common with modern forms. Tracing the evolution of coccolithophores by the ultrastructure of coccoliths reveals that four, possibly five major groups had developed by the end of the Jurassic. These groups expanded and flourished during Cretaceous time, for a period of about 65 million years, but only one more major group developed during this time. At the end of the Cretaceous, some 65 million years ago, nearly all coccolithophores became extinct in one cataclysmic catastrophe. A few species virtually unknown in previous time, were left to repopulate the oceans of the world, and within less than 10 million years a highly diverse flora of coccolithophores again flourished. Most Cenozoic coccoliths can be traced through their ultrastructure to the survivors of the Cretaceous catastrophe. Two exceptions are the problematic discoasters and sphenoliths, both of which developed about 60 million years ago, and both of which seemingly disappeared from the record within the past 4 million years.

102

SILICOFAGELLATE ULTRASTRUCTURE. S.D. Van Valkenburg, Botany Department, University of Maryland, College Park, Md. 20742. Carbon replicas of siliceous skeletons of *Dictyocha fibula* reveal structural details which indicate a pattern and sequence of formation. An internal siliceous vesicle elongates and branches dichotomously several times. The spinose ends of the branches fuse with other parts of the developing skeleton as they contact them. How the internally-formed skeleton is later extruded to its normal external position, and what is the guidance mechanism that directs the angles of "growth" and hence the "species" of the skeletons, are not understood. The "sunburst" is the most common of the several morphological variants of the *D. fibula* protoplast. In this form the densely-packed perikaryon contains all of the dictyosomes, but none of the chloroplasts. A frothy mass of globular cytoplasmic extensions extend from the perikaryon on thin connecting strands, entangling the exterior skeleton. A viscous, mucilaginous investment extending beyond the pseudopods envelops the organism. It is probable that two other morphologies observed are involved in skeleton formation and extrusion. Ultrastructural work with synchronized cultures is needed to study these phenomena.

103

DINOFLAGELLATES: ORGANELLES AND FEATURES. Karen A. Steidinger. Florida Department of Natural Resources, St. Petersburg, FL 33701, U.S.A.

Dinoflagellates are eukaryotes with at least one form in the life cycle being motile and usually having two dissimilar flagella. The theca of motile stages consists of membrane layers and vesicles. The thecal vesicles may or may not contain a structural carbohydrate. A few species have body and flagellar scales. In addition to typical organelles and systems, these flagellates can contain trichocysts, pusules, nematocysts, and eyespots. In photosynthetic species, chloroplasts usually contain lamellae of 2-3 thylakoids and can have interlamellar or projected pyrenoids. There is a wide variety of pyrenoid, pusule and eyespot types and not all species have these organelles. Motile stages contain a distinct nucleus with continually condensed chromosomes attached to the nuclear envelope. Nuclear division is a closed mitosis with extranuclear components. Intracellular chrysophyte symbionts have been observed for two species and evolutionary hypotheses projected. Light intensity and quality and growth stage induce ultrastructural variation. Speculated and demonstrated function of various organelles and features will be discussed.

104

PHYLOGENETIC CRITERIA AND RELATIONSHIPS OF PHYTOFLAGELLATES. K.D. Stewart and K.R. Mattox. Miami University, 45056. U.S.A.

Comparative micromorphological and biochemical studies have contributed partial answers to many old questions concerning structure and function in phytoflagellates. One of the more obvious results, however, has been the posing of many new questions that could not have been asked earlier, or at least not asked in entirely the same way.

A consideration of the relationships between and within the algal classes must now be concerned with a formidable array of items and information, among which are the external and internal flagellar apparatus, external and internal symmetry, nature and evolution of the cell covering, structure and evolution of the mitotic spindle, endosymbiotic or other origin of chloroplasts, and the degree of importance that should be given to pigment differences or similarities. These and other subjects will be discussed as time permits.

105

IN VITRO ASSOCIATION OF AN ENERGETICALLY FUNCTIONAL PHYCOBILISOME COMPONENT OF PORPHYRIDUM SORDIDUM. E. Gantt, C. A. Lipschultz and J. Grabowski. Radiation Biology Laboratory, 12441 Parklawn Dr., Rockville, MD 20852.

Phycobilisomes of *P. sordidum* contain about 15% allophycocyanin (APC), 28% phycoerythrin (B-PE), and 57% phycocyanin (C-PC). All of the B-PE isolates as a complex with half of the total C-PC content. This complex is stable at <0.005 M Na-K phosphate (pH 6.8), unlike phycobilisomes which are most stable at 0.75 M. The complex has major absorption peaks of 570 nm and 623 nm, and a fluorescence emission peak at 650 nm (excitation at 550 nm). The efficiency of excitation energy transfer from B-PE to C-PC, as determined from fluorescence spectra of the intact and dissociated complex, is ca. 97.5%. By chromatography (Sephadex G-200) and electrophoresis (acrylamide gel) the components are not separable, however they can be separated on a linear sucrose gradient. From isolated pigment fractions, thus recovered, *in vitro* formation of an energetically functional complex has been obtained. It has the same C-PC to B-PE ratio (1:1), approximate molecular weight, and energetic competence as the *in vivo* complex. This is the first example of the *in vitro* formation of a partial phycobilisome.

106

EFFECTS OF CARRAGEENAN ON CHICK EMBRYO FIBROBLASTS IN VITRO -- A PRELIMINARY STUDY. E. Tvetter Gallagher, N. Harris, P.C. Morin and T.N. Wight, Jackson Estuarine Laboratory, Durham, N.H., 03824

Chick embryo fibroblasts were cultured in the presence of low or high molecular weight iota carrageenan, chondroitin sulfate, or agar at various concentrations (0.04%, 0.02%, 0.01%, 0.005%) for 48 hours. Scanning electron microscopy (SEM) revealed that fibroblasts treated with carrageenans changed in shape from bipolar to polygonal, exhibited abnormal growth patterns, and adhered more tenaciously to the plastic dishes. The control cells and cells treated with chondroitin sulfate or agar did not exhibit these morphological changes. Transmission electron microscopy (TEM) demonstrated that carrageenan treated cells tended to grow in monolayers; whereas, control cells grew in multiple layers. In addition, carrageenan treated cells exhibited a marked increase in the number of large membrane bound inclusions. Isotopic labelling experiments revealed that iota carrageenan decreased the ability of cells to synthesize and secrete connective tissue glycosaminoglycans. These results demonstrate that low and high molecular weight carrageenan markedly affect growth patterns and metabolism of vertebrate fibroblasts *in vitro*.

107

NITROGEN METABOLISM IN EUDORINA ELEGANS (CHLOROPHYCEAE). A. L. Toby and C. L. Kemp, Simon Fraser University, Burnaby, Canada, V5A 1S6

The study of nitrogen metabolism in *E. elegans* has been aided by the isolation of mutants deficient or lacking nitrate reductase. Studies of growth characteristics and enzyme production have shown these mutants to be of 3 distinct types. Studies of these mutants have indicated that the nitrogen metabolic pathway of *Eudorina* is different from that observed in fungi. The approach used involved examination of the production of cytochrome c reductase, benzyl viologen nitrate reductase, xanthine dehydrogenase, and nitrate reductase under various nutritional conditions.

108

GENETIC STUDIES WITH EUDORINA ELEGANS (CHLOROPHYCEAE). C. L. Kemp and A. L. Toby, Simon Fraser University, Burnaby, Canada, V5A 1S6.

Genetic studies of *E. elegans* are being carried out using mutants isolated following UV light and nitrosoguanidine (NTG) treatment. These mutants include nicotinamide (*nic*), p-amino benzoic acid (*pab*), acetate (*ac*), and reduced nitrogen source (*nar*) requirers, as well as pigment deficient and streptomycin (*str*) resistant strains. Although the *str*-resistant mutants are resistant to only 50 ug/ml they show uniparental inheritance for the trait. The other traits exhibit Mendelian segregation patterns, with linkage being seen between some of the *ac* markers and the *nic* and *nar* markers. A preliminary genetic map is being constructed.

109

PHYSICAL CHARACTERIZATION OF THE DNA OF A METHANOGEN.

Ralph M. Mitchell, Laurel A. Loeblich, Lynn C. Klotz, and Alfred R. Loeblich, III. Departments of Biochemistry and Biology, Harvard University, Cambridge, Massachusetts 02138, U.S.A.

The physical characteristics of the DNA of a methanogenic organism were studied to determine the extent of the similarity to procaryotic or eucaryotic organisms. Cells of the type strain ΔH of *Methanobacterium thermoautotrophicum* are found to have a buoyant density and G + C content (52%) in general agreement with the results of previous workers. The peak is sharp and symmetrical, showing little base composition heterogeneity. No satellites are visible. In agreement with these results, the thermal denaturation profile is monophasic. The T_m of 90.2°C corresponds to a G + C in agreement with the buoyant density results, indicating a lack of unusual bases. Preliminary optical renaturation kinetic experiments show a genomic complexity comparable to that of *E. coli*. For hydroxyapatite renaturation studies 3H -radiolabelled ΔH DNA was prepared by the method of nick translation. These experiments are now in progress. From them we hope to determine the extent of fold-back DNA and the extent of repeated DNA, if any.

110

DIFFERENTIAL EFFECTS OF METHYLGLYOXAL ON ANABAENA CYLINDRICA AND SCENEDESMUS QUADRICAUDA. C.B. McIntire and B.D. Vance, North Texas State University, 76203, U.S.A.

Methylglyoxal totally inhibits the photosynthetic enzyme d-ribulose-1,5-diphosphate carboxylase in *Anabaena cylindrica* and slightly inhibits the enzyme in *Scenedesmus quadricauda*. Growth is completely inhibited in *Anabaena*, but there is a stimulation or slight growth enhancement in *Scenedesmus* cultures.

111

A CHARACTERIZATION OF ALKALINE PHOSPHATASE IN THE OCEANIC DINOFLLAGELLATE PYROCYSTIS NOCTILUCA. R.B. RIVKIN AND E. SWIFT. GRADUATE SCHOOL OF OCEANOGRAPHY AND DEPARTMENT OF BOTANY, UNIVERSITY OF RHODE ISLAND, KINGSTON, R.I. 02881, U.S.A.

Alkaline phosphatase (AP) has three kinetic phases between 0.1 and 222 μM substrate and an 8 fold variation in K_m . AP is thermally stable with maximum activity at 50°C. A break in the Arrhenius plot at 35°C corresponds to a change in activation energy of 45 Kcal mole⁻¹ and implies the enzyme is membrane bound. Cytological and cell fractionation studies suggest the enzyme is localized at the cell periphery or plasmalemma. Prior light history and orthophosphate repression are the primary variables regulating the activity of this enzyme. A diel pattern of AP activity which was linked to changes in oxidative metabolism was observed in both laboratory cultures and field populations of *P. noctiluca*. In the absence of protein synthesis orthophosphate repression did not occur, strongly suggesting that an inhibiting protein induced by orthophosphate rather than orthophosphate itself was responsible for the repression of enzyme activity.

112

AN INVESTIGATION OF PHOTOSYNTHETIC RATES IN A FAST GROWING STRAIN OF THE RED ALGA GIGARTINA EXASPERATA. J.E. Merrill and J.R. Waaland. Department of Botany, University of Washington, Seattle, 98195, U.S.A.

Photosynthesis and respiration rates of blades from a selected, fast-growing strain of the marine red alga *Gigartina exasperata*, a carrageenan producer, were measured and compared with rates similarly obtained from wild material of the same species. The measurements were made over a wide range of temperatures and light intensities. Measurements were made with an oxygen electrode at 5 to 750 $\mu E \cdot m^{-2} \cdot sec^{-1}$ light intensity range and 6 to 22°C temperature range and expressed as $\mu l O_2 \cdot mg chl a^{-1} \cdot min^{-1}$. The photosynthesis vs. light intensity data are best described by hyperbolic functions. The data are used empirically to predict the effects of manipulations of light intensity and temperature in aquaculture operations.

113

THE RELATIONSHIP OF PHOTOSYNTHESIS AND DARK RESPIRATION TO GROWTH IN CAULERPA PASPALOIDES (CAULERPACEAE). S.W. O'Neal. Biology department, University of Miami, 33124, U.S.A.

An intensive field investigation of apparent photosynthesis, dark respiration and growth of *Caulerpa paspaloides* was conducted for at least one year in the waters off Key Largo, Florida. In addition, various environmental parameters were monitored during the study period. Apparent photosynthesis exhibited a unimodal seasonal pattern with maximum rates being recorded from late spring to late fall and minimum rates being recorded during the winter months. A seasonal pattern was not detected for dark respiration. Growth exhibited a bimodal seasonal pattern with maximum rates occurring during the spring months and to a lesser degree during autumn. Growth rates were minimal during both the winter and summer months. The independence of growth and photosynthesis during the summer appeared to be the result of a high temperature inhibition of growth related processes other than photosynthesis.

114

LOW SALINITY TOLERANCE AND THE EFFECT OF SPRING WATER ON THE DISTRIBUTION OF BOSTRYCHIA BINDERI (RHODOPHYTA) IN FLORIDIAN ESTUARIES. R.P. McIntosh and C.J. Dawes. Department of Biology, University of South Florida, 33620, U.S.A.

The effects of chemical constituents of spring water on the photosynthetic rates of *Bostrychia binderi* were investigated in regard to tolerance of the red alga to changes in salinity. The components studied were Ca^{+2} , HCO_3^- , NO_3^- and PO_4^{+3} as well as total organics. Plants were grown at 0, 5, 10, 20 and 30 ppt utilizing natural and artificial spring water systems and varying the constituents. Initial study indicated that plants held in seawater diluted with spring water had higher photosynthetic rates with the maximum peak at a lower salinity than did plants held in seawater diluted with distilled water. It was determined that a shift in the photosynthetic peak was due to increased levels of bicarbonate and nutrient present in the natural water. The levels of calcium in the spring water enables the plant to maintain higher photosynthetic rates for longer periods of time at salinities between 0 and 5 ppt. The highly diverse algal flora, characteristic of estuaries on the west coast of Florida is probably maintained by the spring water that is added to the coastal rivers.

115

DIURNAL PHOTOSYNTHETIC RHYTHMS AND PRODUCTION OF TWO FLORIDA BENTHIC ALGAL SPECIES, *BOSTRYCHIA BINDERI* HARVEY AND *GRACILARIA VERRUCOSA* (HUDSON) PAPENFUSS. W.E. Hoffman and C.J. Dawes. University of South Florida, 33620, U.S.A.

Bostrychia binderi and *Gracilaria verrucosa* from two sites, Weeki Wachee River (WWR) and Cockroach Bay (CRB), were tested for rhythmicity of photosynthesis. Hourly photosynthetic rates were determined for each population by $1\frac{1}{2}$ hr incubations over a 24 hr period using the Winkler technique *in situ*; each population showing a peak in photosynthesis in mid morning, dropping to low levels in the afternoon. Plants held in constant light show a dampening of the rhythm compared to those held in ambient photoperiod when alternate sets were run under constant conditions in the Gilson Respirometer indicating the rhythm is endogenous. 14-C was used to obtain the following PQ's for each population: *Bostrychia*, WWR 1.4; CRB 1.2 and *Gracilaria*, WWR 1.3; CRB 1.2. Quadrat work, oxygen evolution, and PQ data were used to calculate net production ($\text{g C/m}^2/\text{day}$): *Bostrychia*, WWR 0.179; CRB 0.141 and *Gracilaria*, WWR 0.216; CRB 0.160. Possible explanations and implications of the photosynthetic rhythm are discussed. A brief comparison of the methods used is presented.

116

THE ECOLOGY OF *SARGASSUM PTEROPLEURON* (SARGASSACEAE) IN THE WATERS OFF SOUTH FLORIDA: SEASONAL GROWTH, REPRODUCTION, PHOTOSYNTHESIS AND RESPIRATION, AND CHEMICAL COMPOSITION. J.S. Prince and E.L. Daly. Biology Department, University of Miami, 33124, U.S.A.

Over a two year study period maximum growth occurred during the late summer followed by the onset of reproduction. Reproduction occurred concurrently with both a reduction in daylength to less than 11.5 hrs. and a drop in water temperatures. Alginate and mannitol concentrations on a whole plant basis increased as the growth rate increased, protein and ash concentrations remained relatively constant throughout the year. Only slight seasonal variations were observed in the alginate and mannitol concentrations, however, when different parts of the plant were analysed; highest concentrations were found in air bladders and reproductive axes. Laminarin concentrations appeared to decrease in the perennial portions of the plant with the initiation of growth in the spring.

117

PHOTOHETEROTROPHY IN THE PYRRHOPHYTA. L. C. Morrill and A. R. Loeblich, III. Department of Biology, Harvard University, Cambridge, Massachusetts, 02138, U.S.A.

Members of the division Pyrrhophyta have been tested for the ability to live: a) in the dark, b) in light below the compensation point, and c) in high light in the presence of the photosynthetic inhibitor, DCMU. 50 mM glycerol stimulated growth under conditions of both dim light and DCMU inhibition in several organisms. Soil extract stimulated growth of *Cachonina niei* in the presence of DCMU, however not in dim light conditions, indicating that this effect results from an inactivation of the inhibitor rather than from a stimulation of photoheterotrophic growth. Soil extract had little effect on the growth of *Peridinium foliaceum* in the presence of DCMU. In the absence of the inhibitor, soil extract permitted growth to higher densities than otherwise possible. Further experiments indicated that this effect is due to additional nitrogen sources present in soil extract.

118

ECOPHYSIOLOGICAL ACTIVITY OF HYPOLITHIC DESERT ALGAE.

T. Berner, Dept. of Biology, Oranim, Haifa University, K. Tivon, ISRAEL. M. Evenari, Dept. of Botany, Hebrew University, Jerusalem, Israel.

Algae were found under flint pebbles, partly buried in loess, in the northern Negev, Israel. The water requirements of those algae seem to be met by regular dewfall rather than the infrequent showers. In the humid pocket under the pebble, the CO_2 concentration rises to 700 ppm. Several hours after sunrise, the temperature of the pocket is $15\text{-}20^\circ\text{C}$, a temperature range which was found to be optimal for CO_2 fixation *in vitro*. At this time light under the stones is sufficient to permit photosynthesis. Whereas most algae require water for CO_2 fixation, the hypolithic algae can fix CO_2 at a relative humidity as low as 75%. These algae reacted quickly to wetting; measurable CO_2 -fixation was found 15-20 minutes after water addition.

119

LIFE HISTORY STRATEGIES IN THE CHRYSOPHYCEAE: THE EXISTENCE OF MATING TYPES IN *DINOBRYON CYLINDRICUM* AND THE IMPLICATION IN OBSERVED DYNAMICS OF NATURAL CHRYSOPHYTE POPULATIONS. CRAIG D. SANDGREN. FRIDAY HARBOR LABORATORY, FRIDAY HARBOR, WA. 98250.

Mating experiments with 15 clonal strains of *Dinobryon cylindricum* suggest the existence of sexual compatibility between some strains. Other strains appear self compatible, but produce statospores with lower frequency than do the sexual crosses. The *Dinobryon* statospore is binucleate in all crosses examined and in several natural populations. These results provide a new tool for explaining observed dynamics of natural chrysophyte populations, and imply the existence of several alternative roles for the statospore in a chrysophyte life history.

120

CHROMOPHYTON ROSANOFFII WORONIN (CHRYSOPHYCEAE): AN ENIGMA. R. L. Meyer. Department of Botany & Bacteriology. University of Arkansas, 72701, USA.

Chromophyton rosanoffii has been assigned to two additional genera, i.e. *Chromulina* and *Ochromonas*. The primary characteristic used to assign this organism to these other taxa has been the number of flagella. Vegetative cell structure, internal formation of a lorica, and statospore production will be described. Taxonomic significance of cell characteristics will be discussed.

The role of the lorica in the migration of the cell to a epineustonic position will be described.

121

SENESCENCE IN VOLVOX. G. Hagen and G. Kochert. Botany Dept. University of Georgia, 30602, USA.

A mature asexual spheroid of the genus *Volvox* consists of two cell types—a large number of somatic cells and a few reproductive cells (gonidia). The gonidia cleave to form daughter spheroids, while the somatic cells, having lost the capacity to divide, die after the daughter spheroids are released from the parent into the surrounding medium. The potential use of somatic cells as a system to study senescence is being examined. Techniques to separate somatic cells from gonidia and daughter spheroids and to dissociate them from surrounding sheath were developed using mechanical homogenization, filtration through Nitex and the French press. Polypeptides synthesized in these cells were examined after $^{35}\text{S}\text{O}_4$ labeling, isolation of total soluble proteins and fractionation of the polypeptides by one dimensional gel electrophoresis in the presence of dodecyl sulfate and by two dimensional gel electrophoresis (urea or isoelectric focusing in the first dimension and SDS in the second dimension). Radioactive polypeptides were visualized by fluorographic techniques.

122

DEVELOPMENT OF A RADIOIMMUNOASSAY FOR THE SEXUAL HORMONE OF *VOLVOX CARTERI* F. WEISMANNIA (CHLOROPHYCEAE). John E. Hill and Gary Kochert. University of Georgia, 30602, U.S.A.

The sexual hormone of *Volvox carteri* f. *weismannia* is a glycoprotein. Since it is potentially analogous to mammalian gonadotropins, it offers the possibility of studying the mechanism of glycoprotein hormone action in a less complex system. For these investigations it is essential to have a sensitive assay, preferably one which is reasonably quick and simple. The bioassay which is presently used to detect the hormone is sensitive but time-consuming. Since the hormone can be labelled to high specific activity with ^{125}I , a radioimmunoassay would be a more efficient assay. Antibodies to the hormone have been obtained which give a single band on Ouchterlony plates, but the antigen-antibody complex does not precipitate well. A radioimmunoassay procedure for the detection and quantitation of this hormone will be presented which utilizes *Staphylococcus aureus* A protein to precipitate the complex. This procedure will also be compared to a radioimmunoassay using the double-immune method of precipitation and to the bioassay with respect to sensitivity and convenience.

123

SPERM BUNDLE-SOMATIC CELL INTERACTION IN THE VOLVOX FERTILIZATION PROCESS. S. J. Coggin¹, W. Hutt² and G. Kochert¹. ¹Department of Botany, University of Georgia, Athens, Georgia, 30602 and ²Department of Biology, Mars Hill College, Mars Hill, North Carolina, 28754.

The fertilization process in the green alga *Volvox carteri* involves a series of steps. Sperm bundles are released from sexual male spheroids and upon encountering a sexual female spheroid, bind specifically to the somatic cells of the female spheroid. After binding, the sperm bundle dissociates into individual sperm cells and forms a fertilization pore in the sheath of the female spheroid. Investigation into the fertilization process has shown that sperm bind specifically only to egg bearing spheroids of the same species. Deflagellation of sexual female spheroids prevents sperm bundle binding. Mild protease treatment of whole female spheroids prevents sperm bundle binding. These results suggest that proteins on the surface of the female spheroid's flagella mediate sperm bundle binding. Fertilization pore formation but not sperm binding is blocked by soybean trypsin inhibitor, suggesting a trypsin-like enzyme activity is responsible for forming the fertilization pore in the sheath of the female spheroid.

124

BINDING PROPERTIES OF RADIOIODINATED SEXUAL PHEROMONE IN *VOLVOX CARTERI* F. WEISMANNIA. T. Noland, I. Yates, and G. Kochert. Botany Department, University of Georgia, Athens Georgia 30602.

Differentiation of female colonies of *Volvox carteri* f. *weismannia* is mediated by a glycoprotein produced by males in a separate clone. Although binding of the ^{125}I -labeled sexual pheromone to intact organisms has been shown to attain equilibrium and exhibit reversibility, our attempts to demonstrate competition between labeled and unlabeled ligand remain inconclusive. Preliminary evidence does suggest that binding to intact organisms is species specific. Experiments examining the binding of labeled pheromone to isolated reproductive cells will be discussed.

125

THE INFLUENCE OF APONIN ON SELECTED DIATOMS AND DINOFLAGELLATES. R.E. Moon, L. Eng-Wilmot, D.F. Martin. Department of Biology, Department of Chemistry, University of South Florida, 33620 U.S.A.

A bio-active compound (Aponin) has been isolated from the marine blue-green alga, *Gomphosphaeria aponina*. Aponin has proven cytolytic towards the red-tide organism *Gymnodinium breve*. The effect of aponin on other constituent flora is tested.

126

PRELIMINARY ULTRASTRUCTURAL OBSERVATIONS ON THE DEVELOPMENT OF THE AUXOSPORE OF THE FRESHWATER CENTRIC DIATOM *CYCLOTELLA MENEHINIANA*. H. J. Hoops and G. L. Floyd. The Ohio State University, Columbus, 43210, U.S.A.

The auxospore of *Cyclotella meneghiniana* was studied using Nomarski optics, and transmission and scanning electron microscopy. The auxospore differs from the vegetative cell in the size of the vacuole, nature of the wall, the presence of a partial sheet of peripheral endoplasmic reticulum, and the frequent appearance of at least one degenerating nucleus. The auxospore wall appears similar to the one previously described for *Melosira*, but in *C. meneghiniana* it is thin, flexible and fragile. Sections of both the vegetative cell and the auxospore contain doughnut shaped profiles of mitochondria. The initial stages of nuclear division appear similar to those observed in the vegetative cells with the extranuclear spindle formed between two plates (polar complexes). Other events associated with the development of the auxospore will be described.

Taxonomy of *Chaetomorpha linum* (Muller) Kuetzing and *C. atrovirens* Taylor (Chlorophyceae). S.M. Blair, A.C. Mathieson, and D.P. Cheney. Jackson Estuarine Lab., University of New Hampshire, Durham, New Hampshire, 03824.

In the past questions have been raised regarding the separation of *C. linum* and *C. atrovirens*. Accordingly a study was conducted to test the possible conspecificity of the two species through the determination of morphological variability in nature and culture, and the assessment of genetic similarity with starch gel electrophoresis. *Chaetomorpha linum* and *C. atrovirens* show an overlap in morphological characters used in their separation (cell length and cell width). However a discontinuity was demonstrated using their average length/width ratios. The two species exhibit low indices of genetic similarity (% similarity and phenotypic identity). Culturing the species showed a large degree of morphological variability. However the two species remained separable by their length/width ratios. The degree of genetic difference remained after culturing. Based on the morphological discontinuity exhibited by *C. linum* and *C. atrovirens*, and electrophoretic evidence of genetic separation, the two species are considered to be valid entities.

This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.