

Phycological Trailblazer

No. 36

Richard Norris

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Richard Earl Norris, who was born in Seattle, Washington, on April 13, 1926, had a very early introduction to the algae. This early interest sparked a life-long dedication to the algae, both micro- and macro-, of freshwater, marine and brackish habitats, of intertidal and subtidal habitats or out on the high seas, and of all groups. I think that a hallmark of his illustrious career is that he has had such an all-encompassing fascination with the algae. Few contemporary phycologists have maintained such a broad outlook in their research on the algae. Over his long career he published essentially on all categories: red algae (including the corallines), green algae (including prasinophytes), brown algae, Chrysophyceae, diatoms, prymnesiophytes (including the coccolithophorids), choanoflagellates, euglenoids, and dinoflagellates. With David Hibberd, he was the first to recognize and establish the new division Chlorarachniophyta. His papers cover the “water-front”: systematics, morphology, ecology, ultrastructure, and culturing and life-history studies. In the current age of specialization, it is rare that a researcher carries on such a broad perspective on the algae, and Rich Norris is such a rare individual.

As an undergraduate at the University of Washington, Norris took a summer course on algae taught by Prof. H. Weston Blaser at Friday

Harbor Laboratories on San Juan Island, and that was pivotal in orienting his future plans toward phycology. For his doctoral research, he studied at the University of California, Berkeley, under the supervision of Prof. G. F. Papenfuss (Norris 1983b). He undertook a study of the Kallymeniaceae, a family of red algae with extremely complicated pre- and post-fertilization stages. He spent long hours at the microscope, and with his camera lucida he unraveled the very complicated pre- and post-fertilization stages to grasp what was going on. In his 1957 thesis publication he explained these stages and also that there was a transition from the

polycarpogonial condition to the monocarpogonial system in the genus *Callophyllis*. He also concluded that procarps seemed to have had an independent origin in the family Kallymeniaceae, and he established that the procarpal condition is polyphyletic in the red algae.

After completing his PhD, he stayed in Berkeley, and he and his wife Louisa were employed by the Radiation Laboratory of UC. They maintained large, bacteria-free cultures of algae of numerous phyla (Norris, L., et al. 1955), and some of these strains were used by Melvin Calvin in his experiments on photosynthesis. Calvin, who would be awarded the Nobel Prize for Chemistry in 1961, elucidated the molecular steps in carbon fixation (the light-independent “Calvin Cycle”).

Two of the three Norris children, Richard, Jr., and Jack, were born in Berkeley [Their third child, Laura, would be born in Minneapolis]. In 1955 Norris joined the Botany Department of the University of Minnesota, where he stayed until 1962. During that period in the Twin Cities, he supervised Richard Meyer in his doctoral research and Rita Horner and Robert



Richard Norris in Hawaii.
(Photo by Terilee Wingate)

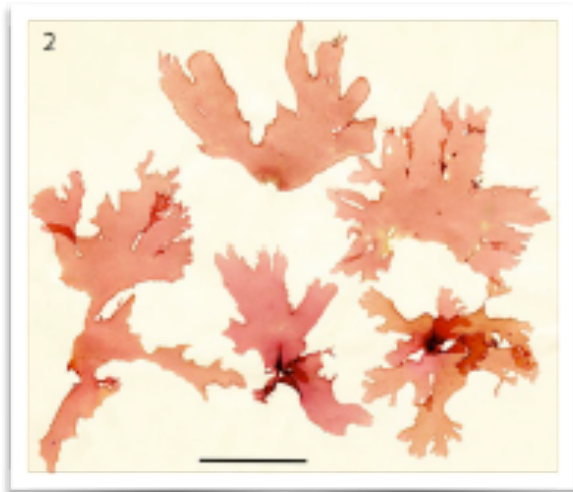


Fig. 1. *Thamnophyllis pocockiae* R.E. Norris. Paratype (in MICH) from Strandfontein, South Africa. Scale bar: 4 cm.

Rasmussen for their Masters degrees. He also ventured to New Zealand on a Fulbright Fellowship in 1958 and again in late 1962-early 1963, when he made collections of marine algae at Ringaringa and at Halfmoon Bay. He later collaborated with Nancy Adams, Elsie Conway, and Mrs. E. Willa in compiling a list of the algae of Stewart Island (Adams et al., 1974). He has also published on his studies of the phytoplankton observed in Wellington Harbour (Norris, 1964a). He later resumed his earlier interest on the Kallymeniaceae and published on that family in South Africa (1964b), describing the new genus *Thamnophyllis* based on *T. pocockiae* (Fig. 1). With Bryan Womersley, he studied and published on the members of this family from southern Australia (Womersley & Norris, 1971).

In 1961 Norris became a staff member of the U. S. National Museum (Smithsonian Institution). At this time there was the ambitious International Indian Ocean Expedition. With support from the U.S National Science Foundation and as part of the U.S. Program in Biology, he joined two cruises of the R/V *Anton Bruun* in the Indian Ocean, the first cruise within the Bay of Bengal and the second cruise following the 70°E longitude from Bombay to 37°S latitude and returning northward to Sri Lanka on the 80°E longitude. Despite the hardship of a rocking ship on the high seas, he

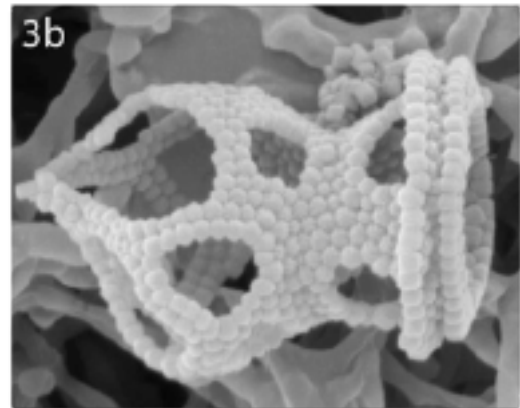
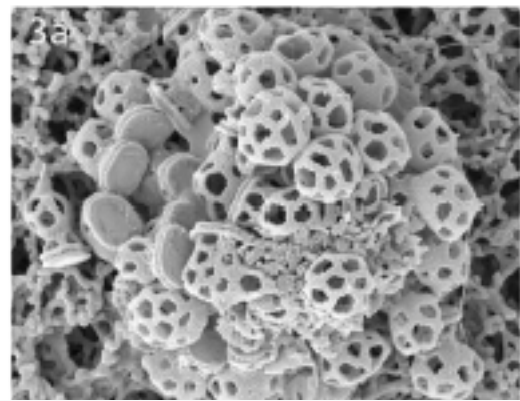


Fig 2. (a). Coccosphere (collapsed) of *Gliscolithus amitakarenae* R.E. Norris and (b) a single coccolith, termed a gliscolith. (Images courtesy of Dr. Claudia Sprengel and Dr. Jeremy Young). Scale bar: 1 μ m.

managed to capture photomicrographs of the phytoplankton, depicting living unarmored dinoflagellates (Norris, 1966). *Ceratolithus* had been known only from the fossil state. He was the first to observe living cells of this genus and erected the new family Ceratolithaceae (Norris, 1965a). In another publication Norris (1967a) described “algal consortisms” observed in the plankton. He captured images of living dinoflagellates, silicoflagellates, and diatoms with symbiotic cyanobacteria as well as radiolarians and ciliates harboring zooxanthellae and green algae. He took numerous plankton tows for later examination back in the lab, which resulted in several publications. He was particularly drawn to algal groups that were notoriously difficult to preserve. By examining the gut contents of salps, he was able to make observations on some rare and unusual species

of both calcareous and siliceous nannoplankton (Norris, 1971a, b). Some of this research on these Indian Ocean collections was not published until some years later, such as two elegant studies that included the ultrastructure of two families of coccolithophorids, the Rhabdosphaeraceae and the Calyptosphaeraceae, with keys to the genera (Norris, 1984a, 1985b). He described a new kind of coccolith, the gliscolith, in his new genus *Gliscolithus* (Norris, 1985b, c) (Fig. 2).

While he was in Bombay, India, after the conclusion of his second cruise on the Anton Bruun, Norris received an offer of a position from the University of Washington, his undergraduate alma mater. He accepted the offer and quickly found himself being called upon to mentor several graduate students. Over his tenure at the University of Washington, Norris became mentor to numerous graduate students, both Masters and Doctoral candidates, and because these students themselves had such varied research

interests, it caused Rich to move into many new areas of research. He supervised many doctoral students, including John West, Dick Steele, Bob Vadas, Rita Horner, Marilyn Harlin, Shirley Van Valkenberg, Ron Hoham, Phil Lebednik, Tom Mumford, Susan Munch, Charles O'Kelly, John Hardy, Craig Sandgren, Dong Ho Kim, and Braam Pieterse, and Masters students Ray Hinchman, Fred Weinmann and Dennis Russell. Indeed these students expressed the gamut of algal interests, from freshwater chrysophytes (Sandgren and Munch) to snow algae (Hoham), from marine diatoms (Horner, Russell) to cold-water crustose coralline algae (Lebednik). His student Shirley Van Valkenberg was the first

person to succeed in maintaining silicoflagellates in culture (by slightly reducing the salinity and in growing them in large vessels) and to obtain many new insights about their biology and taxonomy, thanks to her obtaining clonal cultures and then observing the range of variation in their skeletons left behind in the culture dishes (Van Valkenberg, 1971a, b; Van Valkenberg & Norris, 1970). Norris had the good fortune of spending many summers teaching at Friday Harbor Labs, and this allowed him to make many discoveries of new records of

seaweeds for the local flora (Norris & West, 1966, 1967; Norris & Wynne, 1968; Norris & Hollenberg, 1969). His interests continued to be broad. He studied neustonic marine choanoflagellates from the tidal pools of California and Washington, describing new genera (Norris, 1965b).

His research included diatoms, and with his student Dennis Russell the new diatom genus *Sameioneis* was described; it grew attached to copepods

(Russell & Norris, 1971). Another new diatom genus that he described was *Nanoneis* (Norris, 1973). It had been found in the gut contents of salps from one of his Indian Ocean cruises. His papers also included a broad survey of the class Prasinophyceae (Norris 1980) and fine-structural studies of a new species of *Pyramimonas*. *P. parkeae* (Norris & Pearson, 1975), named for Mary Parke, as well as a fine structural study of its cell division (Pearson & Norris, 1975).

Norris always made the most of his collecting trips. In 1966 he was invited by Robert Hoshaw and D. A. Thomson to visit the newly established marine laboratory at Puerto Peñasco, Mexico. He noticed the many tidepools that

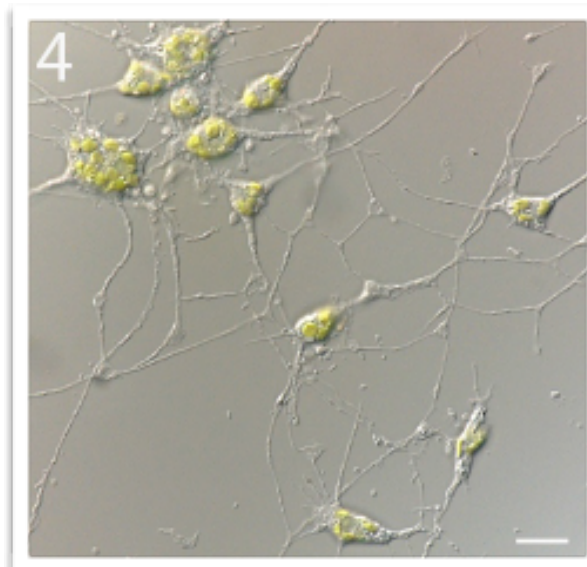


Fig. 3. Colony of *Chlorarachnion reptans* Geitler. (Courtesy of Dr. John Archibald). Scale bar: 10 μ m.

were formed by the receding tides and that these tide pools supported a surprisingly rich microscopic algal flora despite very high water temperatures. He established enriched sea water cultures by sampling the various pools, transported the raw cultures back to his lab in Seattle, and over the following year managed to isolate organisms into unialgal cultures. He observed many interesting taxa this way (Norris, 1967b), but perhaps the most interesting was *Chlorarachnion reptans* (Fig. 3), an amoeboid colonial organism first described by Geitler in 1930 and not seen by anyone since that first account (Geitler, 1930).

Norris maintained this unusual organism in culture for years, and later he collaborated on it with David Hibberd. The two of them were able to provide justification to recognize the new division Chlorarachniophyta and the new class Chlorarachniophyceae (Hibberd & Norris, 1984). Subsequent research by others has led to this division being comprised of seven genera, including *Norrisiella* (Ota et al., 2007). Balakrishnan's (1980) *Norrissia* is a second honorific.

Rich Norris received funding from Guggenheim Fellowships in the period 1969-1970 that allow him to travel and conduct research in several countries, including Great Britain, France, Italy, and Czechoslovakia. He was always happy to collaborate, and this is demonstrated by his research on *Tetraselmis* with his Japanese colleagues Terumitsu Hori and Mitsuo Chihara. This project was funded by the NSF U.S.-Japan Cooperation Research Program, Rich being given the title of "Esteemed Scientist" from the Japanese Society for the Promotion of Sciences. Using isolates from Japan, the State of Washington, USA, and British Columbia, Canada, these workers concluded that *Tetraselmis*, a genus of green flagellates (Prasinophyceae), expressed in culture a broad spectrum of life history changes. They concluded that the genera *Prasinocladus*, *Platymonas*, and *Aulacochlamys* should be treated as congeneric with *Tetraselmis* (Norris et al., 1980). Their collaborative research also include ultrastructural studies of the various subgenera that they recognized within

Tetraselmis (Hori et al., 1982, 1983, 1986). Norris' isolating an unusual marine euglenoid from a seawater aquaculture tank on Lummi Island, near Bellingham, Washington, led to his collaborating with various colleagues. The same flagellate had been isolated by Øjvind Moestrup from a fjord in Denmark. This collaboration led to the description of the new species *Eutreptiella eupharyngea* (Walne et al., 1986).

From the main campus in Seattle, Norris moved to Friday Harbor Laboratories on San Juan Island, where he was a resident professor, teaching courses in the spring, autumn and summer terms. During a sabbatical leave at the University of the Witwatersrand in Johannesburg, South Africa, he met Dr. Fiona Getliffe, whom he was to marry in 1977. They returned to life on San Juan Island. But then in 1980, they made the joint decision to move back to South Africa, initially to "Wits" in Jo-burg, where Fiona, with a PhD in plant systematics, was appointed to a faculty position. When their friend and phycologist Richard Pienaar was appointed Chair of the Botany Department at the University of Natal in Pietermaritzburg, Richard and Fiona made the move to that University, where Fiona was again appointed to a faculty position. It was during this period in Natal that Richard was essentially free to study the marine algal flora of the Natal coast in a serious way. It proved to be one of the most productive periods of his life. There was a prolific output of papers in the years from 1985 through 1993.

He had eleven publications alone in 1987 and another seven in 1988. These papers were primarily on the red algae of the Natal (now Kwazulu-Natal) coastline with many descriptions of new species, many discoveries of new records for South Africa, and many clarifications. In 1987 Rich and Fiona Norris decided to move from Pietermaritzburg to Cape Town, when Fiona was offered the position of Director of Education at the National Botanical Garden located in Kirstenbosch. Rich was appointed Chief Specialist and Scientist at the National Botanical Institute, Cape Town, and although retired from his academic life, he continued to be funded by CSIR

grants and was still very active in his phycological and botanical research.

Fiona Norris was next recruited to take the position of Curator of the Herbarium at the Bernice P. Bishop Museum in Honolulu, Hawaii. So the Norris's once again made a major move, this time from South Africa to Hawaii. For every move all of their prized wooden carvings of African animals would be carefully packed up. Dr. Isabella Abbott offered Richard a research position in the Botany Department. Rich and Izzie had been fellow graduate students under Dr. Papenfuss. They collaborated on publications on the marine algae of Hawaii (Norris & Abbott, 1992; Abbott & Norris, 1993). After several years of island life, Fiona and Rich moved to Fort Worth, Texas, when Fiona was offered a position of Curator and Head of Education at the Botanical Research Institute of Texas. Norris continued to put forth some papers from his work in Hawaii (Norris, 1994a, b, c).

Rich and Fiona looked back at their beloved San Juan Island as the ideal place to eventually retire to. In 1996 they bought a home just north of Friday Harbor Labs, and for a few years they occupied both homes, Rich spending summers on the island to escape the summer heat of Texas. Then upon her own retirement from Fort Worth, Fiona and Rich made the permanent move from Texas to San Juan Island. Their mutual so-called retirement has been extremely active. Both decided to become certified Master Gardeners, and that meant catching a 6 a.m. ferry twice a week for 6 weeks to go to the mainland to take the required courses. They both have been involved in community activities, such as Fiona's serving as Director of Science at the San Juan Nature Institute. Both often give lectures on botanical subjects and act as consultants on botanical topics. They have a large garden and enter the annual San Juan County Fair with their prized plant specimens. I recall being enlisted to help them carry their many Blue Ribbons back home after a successful County Fair. So after a rather peripatetic lifetime, Richard Norris can look back on a professional career of having demonstrated one of the broadest interests in algae, as shown

by his publications, and in also having mentored a large cadre of students, who have gone on to their own successful careers.

Note added on postscript:

Richard Norris passed away on 17 July, 2013, at the age of 87. See Andersen (2014).

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