**Tribute to Professor Grethe Rytter Hasle**

Grethe Berit Rytter Hasle was born on January 3, 1920 and passed away peacefully in her sleep on November 9, 2013 aged 93. She was a Professor of Biology and Marine Botany at the University of Oslo and was active in research until a few weeks before she died. Grethe continued being active not only in Science but also in her personal life, going on skiing holidays with her grandchildren until recently, and continued driving until her death. Linda Medlin remembers her asking why she was driving so slow because the speed limit was 50 and Nina Lundholm remembers Grethe c. 90 years old, driving home at night during a heavy snow fall that kept other people at home.

Grethe Rytter Hasle was born in Borre, Vestfold. Her father, Johan Kristian Rytter,

was helmsman and shipmaster spending much of the time at sea; and leaving her

mother, Nicoline Olava b. Nielsen, at home with Grethe, an only child.

She grew up in Horten at the Oslofjord, where she was active as a scout, and went

skating and skiing in winter and swimming in summer. She was also a frequent visitor to the library in Horten. She graduated from school in Spring 1940 in Horten, and in the Autumn she started at Elverum Teacher Training College, where she graduated in 1942. During the war, Grethe worked as a governess and teacher at the elementary and junior high school. In 1948, Grethe married Hans Martin Hasle who was commander in the Navy and they had two children, Berit Rytter and Jon Rytter Hasle.

When the university reopened after the war, Grethe started science studies at the

University of Oslo. She graduated in Botany in 1949 as a student of Professor Trygve Braarud. Grethe worked in one of the leading international research units in plankton ecology and taxonomy, with several famous scientists, such as Haakon H. Gran, Karen R. Gaarder and Trygve Braarud, and later she became one of the key figures herself.

Since the mid 1900s Grethe has been one of the foremost researchers in the world in diatom morphology and taxonomy. Her studies have helped form the basis for the

modern systematics of diatoms, and remain important for studying plankton and

effects of climate change on their occurrence and distribution. Her general approach

to research emphasizes that in order to conserve biodiversity in nature; we need to

know what is there, where and how much there is and what environmental factors are affecting their occurrence.

Grethe’s first published work from 1950 was on phototactic vertical migration of

marine dinoflagellates, which was part of her graduation thesis, and together with a

follow-up article, it is still cited. In these, she showed that some dinoflagellates are

photosensitive and swim up towards the light during the day and down to deeper

water at night, whereas other species do the opposite.

After graduation, Grethe continued research at the university, first as a research

assistant and PhD student, and from 1961 as a Lecturer in Marine Botany. Grethe

studied algal plankton communities initially in the Oslofjorden, and in the Antarctic

and tropical Pacific. She investigated species composition, densities and distribution

in space and time, and related these to environmental factors governing their

occurrence. As it is today, this was the central question in plankton ecology. In her

doctoral dissertation “An analysis of the phytoplankton of the Pacific Southern

Ocean: abundance, composition, and distribution during the Brategg expedition,

1947-1948”, Grethe examined the phytoplankton in the Pacific part of the Southern

Ocean in Antarctica. She analyzed an extensive amount of material collected during

the Brategg expedition in 1947-1948, and defended this as a philosophical scientific

degree in 1969. Based on the study, Grethe published an article in Nature in 1956

entitled “Phytoplankton and hydrography of the Pacific part of the Antarctic Ocean”.

Grethe spent eight months in the 1960s as a visiting professor at Texas A & M

University where she worked with Antarctic phytoplankton; Greta Fryxell coming

under her supervision as her technician. Afterwards she stayed for a period with Dr.

Friedrich Hustedt in Bremen, where it became evident that diatoms would become her speciality. She turned to diatom taxonomy, ranging from pennate genera (*Nitzschia*, *Fragilariopsis*) to centrics (*Thalassiosira*, *Cymatosira*). She studied diatoms from all over the world, and had a huge collection of fixed and rinsed samples. Linda Medlin recalls working with her on Artic samples and examining her lab notes from 30 +years before and so accurate were her notes that it was possible to retrieve the exact specimen that she had examined. As a pioneer in the use of combined light, scanning and transmission electron microscopy, she became an internationally renowned expert on diatom ultrastructure, describing what would ultimately be termed strutted and labiate processes from the diatom family Thalassiosiraceae.

She has collaborated with many scientists abroad and in her latter studies included

genetic analyses in studies of phylogeny in these collaborations. Grethe has described > 70 new species or renamed many others based on new morphological and later genetic data. She has been particularly involved in the taxonomy of centric diatoms in the genus *Thalassiosira* where she has described or made taxonomic changes to 27 species, such as *Thalassiosira oceanica* Hasle. The high quality of Grethe Hasle’s work is illustrated by her publication in "Skrifter utgitt av Det Norske Videnskaps- Akademi", on *Pseudo-nitzschia*. She paid careful attention to details of the number of striae and fibulae, rows of poroids on the striae membrane, the presence/absence of a central interspace, as well as to diatom type material*.* This ground-breaking work, which was ahead of its time, includes a description of *Nitzschia pungens* forma *multiseries* (now *Pseudo-nitzschia multiseries*), which in 1987 was found to be responsible for the production of domoic acid, causing Amnesic Shellfish Poisoning in Canada. Grethe’s research is, thus, a prime example of the importance of basic science. In her work she always tried to illustrate the full size range of any species because she was well aware of the changes in shape with progressive cell divisions that could lead to misidentifications.

Grethe worked with material made at a time when specimens were exchanged

between scientists and in anticipation of exchange, made many duplicates of her

cleaned and rinsed material. Grethe Hasle’s diatom collection, which was transferred

to the Museum of Natural History at the University of Oslo in 2013, consists of 9000

light microscopy preparations of diatom frustules from different areas (Arctic,

Antarctic, Skagerrak, North Sea, Norwegian coast, Atlantic, Pacific and Indian

Ocean). The collection contains type material of approximately 70 diatom species.

Most of the samples are from Hasle's own research, but the collection also consists of

samples she curated, collected by colleagues or predecessors at the University of

Oslo, dating back to Amundsen's expeditions. A duplicate set of preparations is also

deposited at the Hustedt collection in Bremerhaven.

Hasle taught students at the University of Oslo, but also led international algal courses at expert level under the auspices of UNESCO. The first three were held at the Biological Station Drøbak in 1978, 1980 and 1983. In 1978, all seven teachers were from the University of Oslo. The courses were held afterwards in Naples, Italy where Hasle was central in teaching at these courses, which further contributed to her extensive international network. More than 120 students from all over the world took the courses with Grethe teaching. Her diatom lecture notes from the courses were published in 1996 as part of a chapter on diatoms in “Identifying Marine Diatoms and Dinoflagellates”

Hasle started her career when there were few female scientists in permanent positions. In 1977, she received a personal professorship and became the third female professor at the Faculty of Mathematics and Natural Sciences of the University of Oslo. Grethe became a member of the Norwegian Academy of Science and Letters in 1980 and was for a long time the only female member of Mathematics and Natural Sciences. She has been a member of the editorial committees of several international journals and a number of boards and committees related to her subjects, including Nordic collegium for marine biology. She was very productive and published 133 scientific articles and book chapters, the last co-authored when she was 92 years old.

For her 70th birthday in 1990, a “Festskrift” was published in the journal Nova

Hedwigia with broad national and international participation, which fully confirmed

and celebrated the international recognition she had achieved. In 1999, she received

the honorary "Excellence Award" from Phycological Society of America, and in 2002

she was awarded the "Yasumoto Lifetime Achievement" from the International

Society for the Study of Harmful Algae (ISSHA). She has also been honored by the

diatom genus *Haslea* and the algal species *Dinophysis hasleae*, *Nanoneis hasleae*,

*Praethalassiosiropsis hasleae*, *Thalassiosira hasleae*, *Pseudo-nitzschia hasleana* and *Skeletonema gretheae*. Simonsen remarked on the use of her name for the new genus *Haslea*: a graceful diatom for a very graceful lady.

Grethe Rytter Hasle was not only an outstanding, dedicated and productive scientist

and researcher, but also a patient, generous, challenging, inspiring and wise woman,

and teacher. She would always welcome visting scientists into her home. She has

been a mentor and a role model for many, especially women, in science and many

whom she has helped and inspired will continue the traditions of her work.

We remember her with gratitude, reverence and deep affection.

Bente Edvardsen, Nina Lundholm and Linda K. Medlin

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