



The history of phycology is the history of the scientific study of algae. Human interest back into the origins of the species and knowledge of algae can be traced back many years. However only in the last three hundred years has that knowledge evolved into science.

## EARLY DAYS

The study of Pliny the Elder in the 1st century AD (Irvine and Chamberlain, 1994 p. 11).<sup>[4]</sup>

The classification of plants suffered many changes since Theophrastus (372–287 B.C.) and Aristotle (384–322 B.C.) grouped them as "trees", "shrubs" and "herbs" (Smith, 1955 p. 1).<sup>[5]</sup>

Little is known of botany during the Middle Ages – it was the Dark Ages of botany.<sup>[1]</sup>

The development of the study of phycology runs in a pattern comparable with, and parallel to, other biological fields but at a different rate. After the invention of the printing-press in the 15th century (with the publication of the first printed book: Gutenberg's *Bible* of 1488)<sup>[6]</sup> education enabled people to read and knowledge to spread.

## EXPLORATION OF THE WORLD AND THE ADVANCE OF KNOWLEDGE

Written accounts of the algae of South Africa were made by the Portuguese explorers in the 15th and 16th centuries, however it is not clear to which species reference was being made (Hutchinson, 1973).

## 17TH CENTURY

In the 17th Century there was a great awakening of scientific interest all over Europe. One of the printing-press books on botany were published. Among them was the work of Ray in 1660: *Catalogus Plantarum circa Cantabrigiam.*, this initiated a new era in the study of botany. Ray "influenced both the theory and the practice of botany more decisively than any other naturalist of the latter half of the seventeenth century" (Morton, 1981).<sup>[1]</sup>

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However no real progress was made in the scientific study of algae until the invention in about 1600. It was Anton van Leeuwenhoek (1632–1723) who discovered bacteria of plants. His unsystematic glimpses of plant structure, reported to the Royal Society at his death in 1723, produced no significant advances (Morton, 1981 p. 180).<sup>[1]</sup>

As adventurers explored the world more species of all animals and plants were discovered. The efforts to bring order out of this quickly accumulating knowledge.

The first Australian marine plant recorded in print was collected from Shark Bay on the south coast by William Dampier who described many new species of Australian wildlife in 1699 (Huisman, 2000 p. 7).<sup>[2]</sup>

## 18TH CENTURY

Before Cryptogamia into four orders: Filices, Musci (mosses), Algae – which included lichens and fungi (Smith, 1955 p. 1).<sup>[5]</sup>

Examination for the reproductive structures had already started. In 1711, R.A.F de

<http://users.ugent.be/phycology/harvey/> W.H.H. *Phycologia Australica*

<http://www.botanicgardens.ie/> National Botanic Gardens of Ireland.

<http://www2.nrm.se/fbo/hist/linnaeus/linnaeus.html.en> Carl Linnaeus Botanical History

<http://www.ucmp.berkeley.edu/history/linnaeus.html> Carl Linnaeus

<http://www.algaebase.org/> listing the world's algae

<http://www.seaweed.ie/> Seaweed Site

<http://www.mba.ac.uk/> Marine Biological Assoc. of UK

<http://www.brphycsoc.org/> British Phycological Society

<http://www.intphycsoc.org/> International Phycological Society

<http://www.schweizerbart.de/jalgological-studies/> *Algological Studies is an international journal of phycological*

<http://www.psaalgae.org/> Phycological Society of America

<http://www.phycology.net/> The Phycology.Net

<http://www.tcd.ie/botany/herbarium>

## EXTERNAL LINKS

**Caldwell, I.** 2008. *John Stackhouse (1742–1819) and the Linnean Society. The Linnean.* **24:**37 - 51.

**Darwin, C. R.** 1859. *On the Origin of Species by means of Natural Selection,...* London: John Murray, London.

**Farlow, W.G.** 1881. *The marine algae of New England. Report of U.S. Fish Commission 1879 :Appendix A-1, 1–210.*

**Fritsch, F.E.** 1935. *The Structure and Reproduction of the Algae. Vol. 1.* Cambridge University Press, Cambridge.

**Fritsch, F.E.** 1945. *The Structure and Reproduction of the Algae. Vol. 2.* Cambridge University Press, Cambridge.

**Gatty, M.** 1863. *British Seaweeds.* London.

**Gifford, I.** 1853. *The Marine Botanist;...* Longman and Co., London.

**Grattan, W.H.** (1874?) *British Marine Algae:* London.



# MISCELLANEOUS NOTES

*Algae*

*Botany*

*History of biology*

*History of botany*

*List of botanists*

## SEE ALSO

Recently (1990s) *The Kingdom: Protoctista* has been recommended,<sup>[55]</sup> however, this has not been a

In 1883 and 1897 Schmitz separated the Rhodophyceae into two main groups. The first contained the Nemalionales, Cryptonemiales, Gigartinales and Rhodymeniales (Newton, 1931).<sup>[40]</sup> The Rhodophyta Orders: Porphyridiales, Goniotriconales, Erythropeltidales, Bangiales, Acrochaetiales, Colaconematales, Nemalionales, Gelidiales, Gracilariales, Bonnemaisoniales, Cryptonemiales, Hildenbrandiales, Corallinales, Rhodymeniales and Ceramiales. The Chlorophyta are arranged in the Orders: Chlorococcales, Microchlorophytales, Phaeophilales, Ulvales, Prasiolales, Acrosiphoniales, Cladiphorales, Bryopsidales, Chlorocystidales, Ulotrichales. The Heterokontophyta: Sphacelariales, Dictyotales, Ectocarpales, Ralfsiales, Uteriales, Desmarestiales, Laminariales and the Fucales (Hardy and Guiry, 2006).<sup>[54]</sup>

<sup>[52]</sup> was the first to separate the groups on the basis of colour, however this was not taken up by others who, in 1836, divided the algae into four major divisions solely on the basis of their pigmentation: Rhodospirillales (red algae), Melanospermales (brown algae), Chlorospermales (green algae) and Diatomaceae (Dixon, 1973 p. 232). With the great increase in the number of species the artificiality of the Linnaean system was appreciated so that in the early 19th Century considerable numbers of new genera were described. J.V.F. Lamouroux in 1813 [5] described a number of genera of algae of which only four, Conferva,<sup>[5]</sup> in which he grouped plants according to the position of the stamens and carpels in their flowers, although wholly artificial was advantageous because any new plant could be fitted in amongst those already known. He divided the plant kingdom into two, the Cryptogamia – plants with "concealed reproductive organs" (see also Linnaeus's "sexual system" (Linnaeus, 1754))

## EVOLUTION OF CLASSIFICATION IN THE ALGAE

As the study and identification of the different species became more extensive it became clear that identification was not at all easy. Harvey's 1846–51 *Phycologia Britannica*, along with Harvey's key, makes no effort to provide "keys" to help in the identification. In 1931 Newton's *Harvey's Key* was the first key to assist in the identification of algae of the British Isles, in the same year Eifion Jones in their "Manx Algae."<sup>[46]</sup> Eifion Jones in 1962, wrote a key to the genera of British algae. Soon followed: Dickinson wrote one entitled *British Seaweeds*.<sup>[48]</sup> and Adey and Adey wrote a key to the identification of the Corallinaceae of the British Isles.<sup>[49]</sup> Abott and Hollenberg, in '1971

identification of algae of California.<sup>[50]</sup>

## IDENTIFICATION

At the international level there are well over 3,000 species of alga in Australia.<sup>[2]</sup>

In more localised lists Adams (in 1907) listed the species of County Antrim<sup>[43]</sup> note included in "Batter's List"<sup>[39]</sup> he recorded 211 species from the Co. Antrim coast. In 1857 a list of marine algae from Lambay Island (County Dublin) was published by Batters.<sup>[44]</sup> In 1960 A list of marine algae of Galloway coast was published.<sup>[45]</sup>

As records were collected the need to draw all the information together advance annotated checklists were produced and updated so the actual numbers of different species became more precise. At first this was quite local. Threlkeld, in 1726, produced the first attempt at a list of Algae and in 1802 William Tighe published his "Marine plants observed at the County of Wick" listing 58 marine and 2 freshwater species. In 1804 Wade published *Plantae Rariores in Hibernia* listing 10 species of marine and 4 species of freshwater algae were enumerated. In the north of Ireland Templeton and William Thompson were at work publishing on the algae of Ireland in 1845. His *Flora Hibernica* including 296 species. Adams, in his synopsis of 1908, listed a total of 843 species reaching 843.<sup>[42]</sup>

## NUMBERS AND CHECKLISTS

Research advanced so quickly that the need for an up-to-date checklist became acute. In 1902–1981, who was a founder member of the British Phycological Society, produced a checklist of British marine algae in 1953, corrections and additions of this were published in 1968. M.Parke and Peter Stanley Dixon (1929–1993) published a revised check-list, a second edition produced in 1968 and a third revision in 1976. Distribution was added to the checklist in 1976. and I.Tittley's *A Checklist and Distributional Index of the Benthic Marine Algae of the North Atlantic* and *Atlas of the Seaweeds of Britain and Ireland* was published by Gavin Hardy and Michael J. Wynne in 2006. This shows how rapidly knowledge of algae, at least in the British Isles, has advanced. Efforts had been made by interested biologists and people capable of identifying plants from books using the botanical names. Botanical keys to identify the plants then developed into checklists. As more information was brought to light by interested workers, some of these keys were improved and eventually a mapping scheme brought together all this information. This knowledge developed with birds, mammals and flowering plants, though to a different degree. Knowledge in other parts of the world has developed to this degree.

The process accelerated in the 20th century. Lilly Newton (née Batten) (1893–1981) at the University College of Wales, Aberystwyth and Professor Emeritus in 1931 wrote: *A Field Guide to the Seaweeds*.<sup>[40]</sup> This was the first, and for quite a time, the only book for identification

Isles using a botanical key. In 1962 Eifion Jones published: *A key to the genera of the British Isles*. This booklet provided a valuable source in the period before the valuable series *Seaweeds of the British Isles* produced by the British Museum (Natural History) or The Natural History Museum.

In 1902 Edward Arthur Lionel Batters (1860–1907) published "A catalogue of the British Seaweeds" (1902).<sup>[39]</sup> In this he detailed records of algae found on the shores of the British Isles. This was the start of a new approach, the bringing together of records, detailed keys, and schemes.

The number of books published in the mid to late 19th century shows how interest in algae developed. Books on algae were written by: Isabella Gifford (1853) *The Marine Botany of the British Isles*; specimens are in the Ulster Museum; D. Landsborough (c.1779–1854) *A Popular History of the British Seaweeds* edition published in 1857; Louisa Lane Clarke (c.1812–1883) *The Common Seaweeds of the British Isles*;... in 1865; S.O.Gray (1828–1902) *British Seaweeds*:... published 1867 and W.H.Grattidge (1828–1902) *Algae*:...published about 1874. These books were for the *common* people.

## DEVELOPMENT OF PUBLIC AWARENESS

In 1935 and 1945 Johan Harald Kylin (1879–1949) was published posthumously. Other contributors who contributed massively to the knowledge of algae include: Elmer Yale Dawson (1918–1980) 60 papers on the algae of the North American Pacific seas (Papenfuss, 1976).<sup>[14]</sup>

In 1895 Børgesen started his study of the Faeroe Islands and published his work in 1920 and 1936 he published his research on the algae of the Canary Islands.<sup>[33][34][35]</sup>

## 20TH CENTURY

. *On the Origin of Species by Means of Natural Selection,...* evolution (1809–1882) published his work in 1859. It was in this period (1859) that [1] It was in the 19th Century that the true nature of

Mikael Heggelund Foslie (M.Foslie) (1855–1905) published 69 papers between 1887–1905. He increased the number of species and forms (of corallines) from 175 to 650 (Irvine and Foslie, 1960). After his death his collection of specimens was purchased by the Museum of the University of Oslo for Sciences and Letters (Thor *et al.*, 2005)<sup>[31]</sup> and there is a small collection of his specimens in the Herbarium: (Collection No. 42) entitled: *Algae Norvegicae* (Ulster Museum Herbarium collection No. F10334). F.Heydrich also described 84 taxa and was a bitter foe of Foslie. This left many and still unresolved problems.<sup>[12]</sup>

Much work was done in this period by many workers and the many specimens become available. Harvey's specimens, are to be found in at least several herbaria as well as those of other workers whose names are to be found in historic publications. In the same period Friedrich

1893) in Germany described more new genera than anyone either before or after (Papenfuss, 1976). His publications span the period 1841 to 1869 and added materially to knowledge of the Arctic seas. Some of his specimens are stored in the Ulster Museum Herbarium (BEL) F10281–F10318. In 1883 he worked in Edinburgh where he worked long hours, yet he was one of the collectors of Scottish algae. Despite bad health he was an indefatigable collector. In 1892 he gave his collection to the Herbarium of the Edinburgh Botanic Gardens (Furley, 1989).<sup>[29]</sup>

## LATE 19TH CENTURY

Sir William Jackson Hooker (1785–1865) was a lifelong friend of Harvey (Papenfuss, 1976). He was appointed Professor of Botany at Glasgow University in 1820 and became Director of the Herbarium in 1840. He recognized the talent in Harvey and lent him books, encouraged and invited him to collect algae in his *British Flora*, as well as the section on algae for *The Botany of Captain Beechey* (Papenfuss, 1976).<sup>[14]</sup> Margaret Gatty (1809–1873) (née Margaret Scott) (author of *British Seaweeds*, 1858) corresponded with William Henry Harvey (Desmond, 1977 and Evans, 2003).<sup>[25][26]</sup>

William Henry Harvey (1811–1866), Keeper of the Herbarium and Professor in Botany at Trinity College, Dublin (TCD) was one of the most distinguished algologists of his time (Papenfuss, 1976 p. 26).<sup>[1]</sup> He visited South Africa, the Atlantic seaboard of America as far south as the Florida Keys, North America and Australia (1854–1856). Between 1853 to 1856 he visited Ceylon, Australia and various parts of the South Pacific (Huisman, 2000 & Papenfuss, 1976).<sup>[2][14]</sup> His collections resulted in one of the most extensive collections of marine plants and it inspired his work. He published: *Nereis Australis Or Algae of the Southern Ocean* in 1847–1849 and in 1846–51 his *Nereis Boreali-Americana* appeared. His *Nereis Boreali-Americana* was published in three parts (1852–1858) this volume (Papenfuss, 1976) is the only marine algal flora of North America as it includes taxa from the Pacific (Papenfuss, 1976 p. 27).<sup>[14]</sup> His five-volume *Phycologia Australica* was published in 1858 to 1863. This is today a most important reference to Australian algae (Huisman, 2000).<sup>[2]</sup> His primary collection is at Trinity College, Dublin (TCD). However large collections of Harvey material are to be found in the University of Leuven (BEL) (Morton, 1977; Morton, 1981);<sup>[22][23]</sup> University of St Andrews (STA) and National Herbarium of Victoria (MEL), Melbourne, Australia (May, 1977).<sup>[24]</sup> Many of the collectors of this period sent specimens freely one to another, as a result Harvey's books show a remarkable knowledge of the distribution of algae elsewhere in the world. His *Phycologia Britannica* lists species recorded from various parts of the British Isles. For example he notes William Thompson (1814–1849) (c.1814–1849), John Templeton (1766–1825) and D. Landsborough (1779–1854) who collected at distinct sites in Ireland. The collections of these botanists, and many others, are recorded in the Ulster Museum (BEL).

## W.H. HARVEY

Specimens of Anne E. Ball (1808–1872) have been found in both the Herbarium of the Royal Botanic Gardens, Dublin [3] and the Ulster Museum (BEL). A.E. Ball was an Irish algologist who worked with Harvey and whose records appear in his *Phycologia Britannica*. The specimens in Dublin are unusual or rare items. However, they are well documented.<sup>[21]</sup>

Freshwater algae are commonly treated separately from marine algae and may be placed in phycology. Lewis Weston Dillwyn (1778–1855) "British Confervae" (1809) was the first to attempt to bring together all that was then known on the British Freshwater algae.

Jean Vincent Félix Lamouroux (1779–1825) was the first, in 1813, to separate the algae of colour (Dixon and Irvine, 1977 p. 59).<sup>[18]</sup> At this time all coralline algae were considered as lichens. Philippo in 1837 published his paper in which he finally recognized that coralline algae were lichens and he proposed the generic names *Lithophyllum* and *Lithothamnion* (Irvine and Chalmers, 1966).

The first records of algae from the Faroe Islands were made by Jørgen Landt in his 1813 paper which mentions about 30 species. Following this, Hans Christian Lyngbye visited the Faroe Islands and published his work in 1819. In this, he described several new genera and species, some of which were listed. Emil Rostrup who visited the Faroe Islands in 1867 listed ten new species. In 1900, Herman G. Simmons mentioned 125 species. In that year F. Børgesen (1869–1942) in 1902 published his work (Børgesen, 1902).<sup>[17]</sup>

Lund in 1839, made a study of the life-histories of algae, described many new genera and species. It was him that many workers sent specimens for determination and as donations. Because of this, the Lund herbarium is the most important algal herbaria in the world (Papenfuss, 1976).<sup>[14]</sup>

## EARLY 19TH CENTURY

The first collector of marine algae in Greenland waters seems to have been J.M.Vahl from 1828 to 1836. Vahl's East Greenland species were not recorded until 1893 when they were mentioned in his work of 1893 together with the species collected by Sylow (Lund, 1959) only 12 species from East Greenland 4 of which are doubtful, these records are based on Vahl's work (Lund, 1959).<sup>[16]</sup>

The real awakening of interest in American algae resulted from a visit by William Harvey when he visited areas from Florida to Nova Scotia and produced three volumes of "Algae of the United States" (1847). These gave an incentive to others to study algae (Taylor, 1972 p. 21).<sup>[15]</sup>

Some taxa referable to *Fucus*; either Menzies collected very few or he gave only a few to Turner. Some species described by Turner later became the types of new genera (Papenfuss, 1976, 2000) <sup>[2]</sup> Turner also received plants from Robert Brown (1773–1858) the botanist who visited Australia with Matthew Flinders on the *Investigator* (1801–1805). This collection also included many species of algae (Huisman, 2000).<sup>[2]</sup>

[14] Knowledge of North American Pacific algae begins with the 1791–95 expedition

The first scientific species description of a South African seaweed accepted for n purposes is that of *Ecklonia maxima*, published in 1757 as *Fucus maximus* (Stegenga et

Harvey commented on *...motion, apparently spontaneous, among the seeds at the period of ge difficult...to account for these anomalous motions. ...that the seeds becomes (how is not said) a per enjoying an animal existence for a time ceases to live animally, and, reverting to its original nature, this seed was first vegetable, then animal, and then again vegeable,...* .<sup>[10]</sup> During the 18th Centu controversy as to whether coralline algae were plants or animals. Up to the mid-18 (and coral animals) were generally treated as plants. By 1768 many, but by no mea considered them animal. Five years later, Harvey concluded that they were certain he noted: "The question of the vegetable nature of Corallines, among which the *M* be considered as finally set at rest, by the researches of Kützing, Phillipi and Deca 73).<sup>[11][12]</sup>

[1]

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