at the station? Why, man alive! what is easier than to tip the guard and engine-driver half-a-sovereign, and have the train stopped just by the goods station?"

The Senior Proctor mentally resolved to be sharper in future. He was sharper—when he caught men. But his sharpness was the sharpness of acidity and not of acuteness.

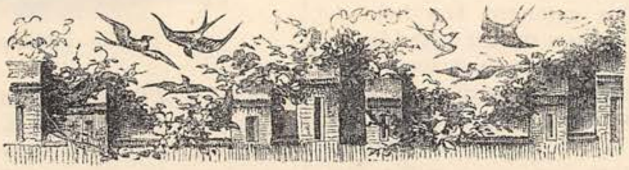
The Brasenose Ale Festival is simply ordinary dinner in Hall, at which some special ale, brewed by the College and kept for high occasions, is given to the undergraduates. Possibly the most important feature, certainly it is the most uncommon, is the fact of the ale being given. Anything not paid for is a fact so rare that it of itself deserves a festival to commemorate it. The ale is celebrated in a poem which is supposed to be written by the College Butler. College Butlers being, however, not necessarily gifted with the poetic faculty, the honour or duty is deputed to some undergraduate. The merits of the verses vary, apparently with the ale, which is sometimes good, often bad, and usually indifferent. In a collection of the productions of laureates of the barrel, lately published, are verses by Bishop Heber, by Garbett, once Professor of Poetry, and others of less reputation. The various later authors may be found in country rectories, doubtless endeavouring on temperance principles to counteract the effects of the obnoxious liquor, which in the days of their youth they celebrated in such thoughtless fashion.

The College bounty did not stop short, however, at ale; cakes of ample proportions were cut up and distributed. But when all rose to bless the indirect giver, and the direct benefactor, it must of course have been indigestion or malicious scepticism which made Frank's host whisper to him—

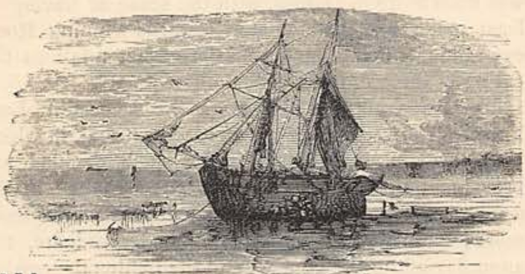
"I wonder what the difference is between the pecuniary value of the bequest when it was made to the College, and its present value."

Frank, not being able to hazard a conjecture, made the most apposite remark his state of ignorance allowed—"You'd better ask the Bursar."

END OF CHAPTER THE SIXTH.



THE PRACTICAL USES OF SEAWEED.



We are all familiar with the seaweed which forms a slippery lining to the rocks on the sea-shore at low water, and all of us have gazed with delight down into the clear depths of sea-water where submarine forests wave in their liquid atmosphere; but until recent years nobody thought that these ocean shrubberies were far more valuable than those which flourish on land. Farmers inhabiting patches of fertile soil beside the restless ocean have, from time immemorial, burnt the seaweed and scattered the ashes over the land for manure; rude nations in scattered colonies have at times been driven to it for subsistence; and lovers of science have plucked it from its native bed to investigate its beautiful structure and classify its almost endless varieties. Such were considered to be the only uses of submarine plants; but the Scotchman who said, in his penuriousness, "Boil stanes wi' butter, an' ye may sup the broo'," was the precursor of a new race of men who, actuated by nature's own principle, sought to utilise everything, however abhorrent and unpromising; and it is to these we owe many of the valuable and wealth-yielding productions for countless generations sealed up in the forests of King Neptune.

Now, however, no longer do we despise the valuable gifts which old Ocean throws ashore after one of his internal storms, but everywhere round our coasts—especially the west of Ireland, and the west and north of Scotland, and in all the Channel Islands—busy hands gather to reap the ocean harvest, and the sea-crop is stacked and cared for as much as that of the land. Anybody who has travelled through Jersey or Guernsey must have been struck with the stacks of sea-drift neatly thatched over and forming an essential feature of most farm-yards; and those who have, like the writer of this paper one memorable summer, gone out in a Sark boat to the island of Herm, to the harvest of *vraic-scié* (cut weed), and the mad frolics with the charming islanders after it was safely gathered, can never cease to have an interest in seaweed. Indeed, so essential to their daily bread is it that they have a proverb which says, *Point de vraic, point de haugar* (No seaweed, no corn-shed); and what is true of the Channel Islands is true of many portions of our western coasts. In many parts of Ireland "dillisk" (Irish, "duille-isk"—water-leaf), and in the west of Scotland "dulse," is accounted a luxury among Irish people, who eat it in a dried state; but it is for the production of iodine that sea-plants assume valuable proportions.

Kelp, roughly speaking, may be described as a crude sort of carbonate of soda, and is obtained by burning plants of the *Laminaria*, the *Fucus*, and the *Chorda* species, which are plentiful around our rocky coasts. It is obtained by burning the dried weeds in pits dug out in the shore-sand till reduced to hard, dark-coloured cakes, and in this condition it is sent to market. As soon as the summer months with their bright days come in, the weed-gatherers, with their long wooden rakes, gather up the sea-drift, and, spreading it out on the broad beaches, allow the sun to dry it, when it is stacked, and during the winter months burned into cakes.

Photography could not exist without iodine, and this material is of considerable value in our pharmacopœia, while many of the subsidiary elements of seaweed form essential ingredients in many of our manufactured products. Iodine was discovered in 1811 by Courtois, a Frenchman, and the original hint was speedily taken up and followed out by Gay-Lussac, who was the first to give a history of its properties. Since then many chemists have turned their attention to it, and though it is never found free in nature, it exists in most marine plants to a considerable extent, and to a scarcely appreciable extent in sea-water. The manufacture of iodine from seaweed was greatly accelerated by the discovery of potash salts. Kelp contains about 42·13 per cent. of soda, but about one-eighth is lost in extracting its essential salts. These contain in 100 parts 360 salt, 140 sulphate of potash, and 490 chloride of potassium, &c.; crude soda has about 10 lbs. of iodine to the ton. The great endeavour hitherto has been to get the salts separated without an undue loss of iodine, and M. Moride has spent years in trying to extract the valuable essence without loss. His experiments have been carried on almost entirely with drift-weed. The raw material collected during the day is dried and then set fire to, as it hangs from a wirework cone, by burning under it damp seaweed. This preserves both the iodine and the bromine, and prevents the accumulation of sulphur, the most troublesome ingredient with which the chemist has to deal in extracting the precious essence. The cinders are lixiviated in the most complete manner possible, when the solution is evaporated by steam, brought into a liquor, and precipitated by a strong solution of sulphuric and nitric acids. The precipitation is shaken in closed vessels submerged in benzine, and having been cleared is dried and ready for the market. His process, however, has been superseded by a later method, employed by a countryman of our own. Mr. Stanford, the originator of the British Seaweed Company, has succeeded in extracting everything valuable out of seaweed. Having gathered his raw material, it is stored under cover to drain, and then dried either in the sun's rays or heated rooms. The weeds are subsequently submitted to hydraulic pressure to lessen their bulk, after which they are distilled in iron retorts kept at a low red heat, the gas generated in the operation being utilised for carrying on subsequent operations, or for lighting the factory. During distillation the seaweed gives off a quantity of tar, which is redistilled, and the volatile oil which then passes over is treated with a weak solution of sulphuric acid, by which the red colouring matter is precipitated. Having decanted the residue of the tar into another still, greater heat is applied, and paraffin oil passes over. This is purified in the ordinary way with oil of vitriol and caustic soda. The pitch that remains is pumped into brick ovens, the heavy vapours and more paraffin being eliminated, and the solid portion is burnt into coke, which is eagerly bought up by ironmasters. It is much more valuable than ordinary coke, because it is almost entirely free from sulphur. Turning now to the condensers, we find that in the process of distillation a quantity of liquid has been left. Being allowed to settle, the tar by specific gravity falls to the bottom, and the lighter fluid, being treated with lime, yields ammonia. It will thus be seen that these once-despised weeds now yield chlorides of potassium and sodium, gas, paraffin oil, sulphate of ammonia, acetate of lime, pure charcoal, colouring matter, and iodine. By Mr. Stanford's process every ingredient is utilised, and, what is of far greater importance, none of the precious iodine is lost during the manifold operations.

Another use to which the charcoal of seaweed has been put is that of a deodoriser. For this purpose it is infinitely superior to earth, not only on account of its cheapness, but because it is a better absorbent, requires a smaller bulk to operate effectively, and dries more readily. Besides this, the dry cake may be burned in properly constructed retorts, the ammonia and other useful concomitants of the excreta saved, and the charcoal be used again and again for the purpose to which it was originally applied. The phosphoric acid, potash, and mineral matters left after the ammonia is given off increase the bulk of the charcoal; and when it can no longer be used as a deodoriser, it may be ground and substituted for bone manure. Not to speak at all of the sanitary advantages which flow from complete absorption of the noxious vapours in closets—a consummation calculated to revolutionise the health of large towns—the utilisation of what is now washed away into the sea by means of sewage systems, the construction of which has cost millions of money, is an element worthy the consideration of social economists.

Seaweed has further been recommended to paper manufacturers as a raw material deserving their attention, the plants best adapted for this purpose being the *Zostera* species and the *Ulva marina*. Patents for making paper from these and other marine plants have been taken out in Holland, France, the United States, Italy, and England at various periods since 1820. Hitherto, however, the endeavour to cheapen our paper supply in this direction has not met with unqualified success; not because the weeds are unfitted for the purpose, but because the processes of manufacture have been more or less inefficient. Specimens of pulp and paper from these waifs of the ocean have been shown in exhibitions at home and abroad from time to time, and the chief fault found in it was its colour. The difficulty hitherto encountered in properly bleaching the pulp has, indeed, been one of the stumbling-blocks in the way of its adoption. A French manufacturer, who employs *Alga* for paper-pulp, has set forth the processes of the manufacture as carried on at his establishment. He first of all pounds the root in order to get rid of a rind or bark which encloses it; then all the sand and grit are washed from it, after which it is well beaten and placed in reservoirs containing a solution of sulphuric acid, in order to soften the fibres and take away their natural toughness. The pulp thus softened is dried in osier baskets or in some other way, and then it is bleached to the required whiteness by means of chloride of lime; after this the manufacture proceeds as if ordinary rag-pulp were used.

Savage peoples located along the sea-shore have, from time immemorial, used seaweed for various domestic purposes; but it was reserved for one of our own countrymen to attempt to introduce to civilised society articles of utility made from the harvest of the sea. He used the stems of *Laminaria digitata*, I believe, for manufacturing such things as imitation horn knife-handles, walking-sticks, book-covers, picture-frames, and knicknacks. Some of the productions by this process were awarded a gold medal at the Exhibition of 1862 for their excellence and novelty. Very likely he got the idea from some fisher-folk who use the same species of plant for making handles to the knives with which they trim the newly-caught fish. I knew an old fisherman on the east coast of Scotland who had for years made "hefts" for all his native village from the thicker stems of seaweed. His process was very primitive indeed. As soon as he got his weed home he cut it into convenient lengths, and while it was yet wet, pushed the blade-hilt down the centre, and laid the article out in the sun to dry. In drying the fibres shrink and grip the hilt of the knife far more firmly than any resinous substance could, and when thoroughly hard it was not unlike buck-horn. In the more northern latitudes fishing-lines are commonly made from seaweed, and in various parts of the world the large leaves of the tropical plants are used for water-bottles, and being perfectly impervious they are not ill adapted for this purpose. Another very ingenious individual conceived the idea of mixing seaweed with coal-tar, pitch, and other substances as a substitution for house coal, in view of the exhaustion of our supply of buried carbon; and it is by no means rare to hear of French upholsterers buying up large quantities of marine grass to be used as stuffing for chairs, sofas, and even mattresses; while those of more utopian ideas have imagined that it might even be treated so as to be made available for being spun into yarn and used in textile manufactures. The utmost that has been done in the latter direction, so far as I know, has been to use it for thatching cottages; or, twisted, it has been made into a rough sort of mat; and I have heard that in the south of France weeds are stuffed between the ceilings and roofs, to prevent the hot rays of the sun from rendering the top flats of tenements uninhabitable. Various species of seaweed, when dried in the open air, effloresce, and these when fermented yield from 8 to 15 per cent. of mannite, a kind of sugar. Others contain such a large percentage of mucilage, that for many years we have imported from Japan and China large quantities of these, which have been used for gum and isinglass; indeed, this kind of isinglass is much prized in certain quarters for making jellies, and so strong is it that one part in 500 parts of water produces a perfect gelatine. Other sorts of seaweed have always been highly esteemed for their medicinal qualities, especially for all affections of the glands; and one species is used by those Alpine races who inherit goître from their ancestors, from some recondite cause, with perfect success.

It is, after all, in China and Japan that seaweed is prized at its proper value, and from these nations we have learned much in the way of utilising it for food. I remarked at the beginning of this paper that in Ireland and Scotland dillisk or dulse was often eaten, but the extreme Orientals have reduced its culinary properties to an exact science. Even we have begun to discover that there are species which contain a large amount of gelatinous ingredients. Among these may be mentioned carrageen, or Irish moss, which is obtained from the *Chondrus mamillosus* and other kindred plants. These are not only mixed with flour to increase the volume, but are used for sizing warps, feeding cattle, glutinising paper-pulp, and a variety of other purposes. Everybody has heard of "sea-moss farina," and this is simply seaweed. One manufactory in New York employs 500 hands, and turns out several tons a day of the fabricated product. The "moss" is simply dried, bleached, freed from all impurities, and sold as an edible. It may require an educated taste to relish a dish of boiled seaweed, and the Western *gourmet* might turn up his nose at a ragout of *Laminaria saccharina;* but there are millions of Chinamen who would give their favourite finger-nail for a good dinner of it, and if they were in very extreme hunger, might even be induced to part with their pigtails for their favourite dinner.

Reverting, however, to the chemical ingredients of the seaweed, these must be set down as its richest treasures, and of all these iodine is incomparably the most precious. As has already been said, it is largely used in photography, and still more largely in medicine, while in the preparation of certain coal-tar dyes it is invaluable. This is the substance used in giving to starch that beautiful blue tint so essential to the getting-up of fine linen and laces; and its power as a colouring agent is demonstrated by the fact that water containing 1-450,000th of its weight of iodine is immediately coloured. It has such an extraordinary affinity for starch that the slightest quantity tends to permeate an enormous bulk. The reason it is employed in starch is because it is a bleaching agent, and makes the linen look white and pure.

W. GIBSON.