THE AQUARIUM.

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B. Fawcett.

MARINE AQUARIUM.

G. Voyez, del.

RUSTIC ADORNMENTS.

THE AQUARIUM.

"A sounding grotto, vaulted, vast,
O'erstudded with a thousand, thousand pearls,
And crimson-mouthed shells with stubborn curls
Of every shape and size, even to the bulk
In which whales harbour close, to brood and sulk
Against an endless storm. Moreover, too,
Fish—semblances of green and azure hue,
Ready to snort their streams." *Endymion.*

CHAPTER I.

The Aquarium is one of the latest and choicest of inventions for the Rustic Adornment of a home, and affords, at a comparatively small expenditure, an immense return in the way of instruction and amusement. Its very difficulties enhance its power of interesting, and add a zest to the enjoyment of success. Considered as a domestic ornament it is insurpassable, and, while in its humblest form it presents a constant succession of beautiful and novel objects, so to all the accessories of artistic decoration, it adds the charm of life in some of its most beautiful and strange developments. The merest glimpse of water is always refreshing to the eye; its clear, cool aspect, the mingling of many colours and forms; the peculiar growth of aquatic plants, and the still more curious forms and movements

of aquatic animals, combine to form an assemblage of delightful and ever-changing pictures.

The Naiads need no longer dwell in forests lone, dipping their white feet in streams haunted only by the robin and the humble bee, but may sport in gay drawing-rooms, in homely parlours, in the study of the recluse, or the chamber of the valetudinarian. No longer need they fear winter storms and March hurricanes, but shall henceforth have homes within sheltered walls, impervious to frost, and shadowed by curtains, where love whispers, and young children play.

To the naturalist the Aquarium opens up new studies of the choicest wonders of the deep sea. Those departments of zoology which have for their regard the creatures of mid-ocean, or even of the pebbled shore, have hitherto made the slowest and least satisfactory progress of any; now they are to experience a "sea-change," for the dredge brings up the

"Pale glistening pearls, and rainbow-coloured shells."

and by the preservation of the creatures in their own element, and under circumstances almost as natural as that in which they were produced, we may study their habits and economy even to the minutest particulars.

We used to study the tenants of the sea by means of wretched specimens, shrivelled up in spirits, or crushed flat between the pages of books. Occasional festoons of sea-weed suspended from the ceiling, or set out upon the mantel, so as to absorb every stray wisp of smoke; a few corals and madrepores, and occasionally a queer-looking stuffed fish, the shape distorted and the colour gone, have long marked the extent of the means for the domestic study of "deep sea wonders;" while the ill-arranged specimens in the British Museum have, for years, been little better than such collections as superannuated sailors delight in, for awakening

or directing public attention to a class of creatures having so few analogies to those of terrestrial origin.

The Aquarium exemplifies, in an instructive manner, the great system of compensation which, in nature, preserves the balance of equilibrium in animal and vegetable life. Indeed the recent adoption of this plan of studying the characteristics of creatures hitherto placed beyond our reach, except when dead and mutilated, has arisen out of the experiments of philosophers as to the nature of that duality of forces which render the two great departments of organized existences essential to each other, not merely for ordinary sustenance, but for the continuance of refined chemical operations essential to their respective organisms. Researches into the chemistry of animal and vegetable bodies, and especially of the effects they severally produce, by respiration, on the medium surrounding them, have resulted in the conclusion that animals and vegetables supply each other with the gases most essential to existence; what the one exhales as effete and obnoxious, the other absorbs for the highest uses of vitality. Animals take oxygen from the medium in which they live, and in return exhale carbonic acid. Vegetables also absorb oxygen gas, and give out carbon; but they also absorb the latter in greater quantity than they exhale it, and during their season of greatest activity throw off more oxygen than they take up at other times. Herein is the first element in the management of an Aquarium, which, to be successful, must contain a sufficient number of plants to supply the animals with atmospheric air for respiration.

Lavoisier was the first who, upon philosophical grounds, established the fact of this balance of influences. De Saussure, in 1780, proved that plants had a tendency to improve the atmosphere, by robbing it of the gases most baneful to animal life; and Priestly, by means of well-devised experiments, ascertained that when atmospheric air had become vitiated by combustion and animal respiration,

plants had the power of restoring it to a normal condition, so as to be again capable of supporting flame, and the breathing of animals. Inglehouse and Ellis contributed to this inquiry, and modern chemistry establishes the fact, that though vegetables absorb oxygen, they do, by the decomposition of carbonic acid into its elements—oxygen and carbon—yield a large quantity of the first element to the atmosphere, while retaining the second for the construction of their tissues.

In the philosophical examination of this subject, the report of Professor Daubeny to the British Association, in 1833, is perhaps the most conclusive and elaborate of any of the contributions of modern chemists. He regarded light as operating upon the green parts of plants in such a way as to enable them to assimilate carbon and evolve oxygen; and concluded that as a very small portion of a tree or shrub generates a considerable quantity of oxygen, there were no reasons to doubt that the influence of the vegetable might serve as a complete compensation for that of the animal kingdom.

Dr. Badham quotes from Fleming to shew that forty years back, it was deemed impossible to maintain at home a collection of living marine curiosities. Fleming, writing in 1815, says, "When circumstances do not permit us to conduct our examinations into the situations which animals usually frequent, we form what is termed a *ménage*, and endeavour, in a confined state, to study those manners which, in a wild state, were precluded from our observation. The aquatic animals are the most difficult to preserve in a living state: they have consequently presented so many obstacles to an examination of their manners, that naturalists remain comparatively ignorant of their history." Now we have them beside us in our rooms, and may study the minutest details of their economy and habits while we sip our coffee, or converse with our friends.

Mr. Ward, the inventor of the mode of growing plants

in glass cases, made a report to the British Association in 1837, in which he called attention to the adaptability of these cases to the development of animal as well as vegetable life; and in 1841, he fitted up in his fern-house in London, an Aquarium which he stocked with gold and silver fish, and aquatic plants.

The formation of a marine Aquarium was first accomplished by Dr. Johnston, one of our most successful students of marine life. In his "History of British Sponges," published in 1842, he describes the formation of a little marine Aquarium in a glass jar, containing only six ounces of sea-water, stocked with living corallines, minute confervæ, ulva, several little mussels, annelides, rissoæ, and a star-fish. The jar was placed upon a table, seldom disturbed, and after eight weeks, the water, still unchanged, had lost little of its capability for the support of animal life; some of the animals were still active, and the coralline was still growing.

Further experiments were made by Mr. Robert Warington, who reported upon them to the Chemical Society, in March, 1850. Two small gold fish were placed in a glass receiver of about twelve gallons capacity, covered with muslin to exclude dust. The vessel was half filled with spring-water, with a bottom of sand and mud, and some loose fragments of limestone and sandstone, so arranged as to form shelter and shade.

A small specimen of *Valisneria spiralis* was, at the same time, planted in the mud and kept in place by a stone. "Everything went on well for a time, till it was found that the natural decay of the older leaves of the plant began to produce turbidity in the water, and a confervoid growth accumulated on the sides of the vessel, and on the surface of the water; to meet this emergency, Mr. Warington introduced a few pond snails, which greedily fed on the decaying vegetable matter and slimy mucus growth, so as quickly to restore the whole to a healthy state."

Here was a complete circle of compensating processes.

The plants grew and increased by offsets, and at the same time exhaled sufficient oxygen to preserve the health and beauty of the fishes. The snails ate up the mucus, and bred rapidly: their eggs and young supplied the fishes with food. Thus the three tenants of the globe maintained each other as in any well-ordered human community; and the water preserved its purity unchanged, and the compensating powers of animals and vegetables were established.

The first marine Vivarium established in London, was constructed by Mrs. Thynne, who made the experiment of bringing some living madrepores from Torquay to London, for the purpose of study and the entertainment of friends; this was in the autumn of 1846. A stone jar was filled with sea-water; the madrepores were fixed on a large sponge by means of a needle and thread. They arrived in London safely, and were placed in two glass bowls, and the water changed every other day. But the six gallons of water brought by Mrs. Thynne, was now exhausted, and must be used again. She here devised means to freshen it for second use. "I thought of having it aerated by pouring it backwards and forwards before an open window, for half or three-quarters of an hour between each time of using it. This was doubtless a fatiguing operation; but I had a little handmaid, who, besides being rather anxious to oblige me, thought it rather an amusement."

Thus the madrepores were supplied with air by means of the agitation of the water, into which they were to be placed, and at the expiration of three months a fresh supply of sea-water was obtained, and all went on well. This success led Mrs. Thynne to further experiments, her narrative of which is so instructive that it seems advisable to quote her own words. She says—

"In the spring of 1847, I wished to try whether I could adjust the balance between animal and vegetable life, and sent for shells and small pieces of rock, to which living sea-weed was attached. On these shells, etc., were sure

to be many zoophytes and other animals, so that I obtained a very various and curious collection of marine creatures. I had a quantity of microscopic corallines, which multiplied very fast; serpulæ, that rapidly elongated their stony cases; some nereis, ophiuræ, and a great many beautiful little things for which I could find no name. On one piece of rock was the first germ of a living sponge. I watched the shooting forth of its spicula with the greatest interest. It was very fine, and grew to the size of a hazel nut, coming to maturity in about six weeks. In the course of the next winter, from want of motion in the water, it had become so covered with dust that I did not know whether it were alive or dead; but in the following June a bright spot appeared on one side, and it threw forth a sporule which attached itself to the rock, and in about six weeks a full-grown young sponge stood beside its parent. I placed this sponge in a darkened room, and found the spicula grew most on whichever side was turned to the light. From this time I regularly placed sea-weed in my glass bowls; but as I was afraid that I might not keep the exact balance required, I still had the water refreshed by aeration. I do not know from which, or whether it was from both causes, that my little flock continued to thrive so much, but I seldom had a death."

Mr. Warington and Mr. Gosse commenced experiments with sea-water, almost simultaneously in the spring of 1852, and with such success as to establish the possibility of adjusting the balance of animal and vegetable life, so that the most delicate productions of the deep sea may be reared in small tanks, with scarcely any detriment to their health and vigour. Mr. Bowerbank, following in the steps of Mr. Ward, in the culture of fresh-water plants and fishes, gave to Mr. Mitchell, Secretary of the Zoological Society, the hint which resulted in the establishment of the interesting Vivaria at the Regent's Park Gardens, unquestionably the most curious and novel scene which those charming gardens con-

tain. The botanist and zoologist have here presented to them, sufficiently close for microscopic examination, those productions of nature which hitherto have been most hidden, and hence least studied of all the tribes that come within their circles of research.

New species have been distinguished, the forms of those already known displayed in all the freshness of life and health, the habits of the creatures in all their moods manifested even more plainly than we could expect to see them, were it possible to watch them in their native deeps; beside this we can watch the growth and reproduction of animals and plants which heretofore we have been wont to make acquaintance with as isolated, mutilated, shrivelled, and dead specimens, happy if we could detect a few of their structural peculiarities after death had contracted, distorted, or destroyed the most delicate and most interesting.

> ———The minutest fish
> Will pass the very hardest gazer's wish,
> And show his little eyes' anatomy. *Keats.*

The Vivaria at the Zoological Gardens have justly attracted popular attention for the novelty and rare beauty of the exhibition; and so perfectly has the balance of chemical operations been adjusted by a proper selection af animals and plants, that "several of the tanks contain sea-water which has not been changed for more than seven months."

Mr. Gosse has embodied the results of his experiments in a volume entitled "The Aquarium, an unveiling of the wonders of the deep sea," published by Mr. Van Voorst. This work is full of that freshness of style which characterizes the works of Mr. Gosse; and for its admirable descriptions and exquisite drawings should be in the possession of every lover of nature, and every keeper of an Aquarium.

I have thus far related the course of events which resulted in the successful establishment of the Aquarium; and will now proceed to treat of it as a domestic ornament.