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**Gatherings of a naturalist in Australasia : being
observations principally on the animal and vegetable
productions of New South Wales, New Zealand, and some
of the Austral Islands /**

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GATHERINGS OF A NATURALIST

IN

AUSTRALASIA :

BEING

OBSERVATIONS PRINCIPALLY ON THE

ANIMAL AND VEGETABLE PRODUCTIONS

OF

NEW SOUTH WALES, NEW ZEALAND,

AND SOME OF THE

AUSTRAL ISLANDS.

BY

GEORGE BENNETT, M.D., F.L.S., F.Z.S.,

FELLOW OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND ;

MEMBER OF THE MEDICAL FACULTY OF THE UNIVERSITY OF SYDNEY, NEW SOUTH WALES ;

AND

AUTHOR OF "WANDERINGS IN NEW SOUTH WALES, SINGAPORE, AND CHINA."

LONDON:

JOHN VAN VOORST, PATERNOSTER ROW.

MDCCCLX.

GATHERINGS OF A NATURALIST.

CHAPTER I.

GENERAL FEATURES OF THE AUSTRALIAN CONTINENT.—CHARACTERISTIC VEGETATION.—BIRDS.—MAMMALIA.—MARINE PRODUCTIONS.—*PHYSALIA PELAGICA*.—FLYING FISH.

THE Continent of Australia, including Tasmania, extends from 10° to 45° of South latitude and from 112° to 154° of East longitude, and is about 3000 miles in length and nearly the same in breadth ; it comprehends therefore almost every climate, from the tropical to that of the colder countries of Europe. The vegetation is remarkable in character—in many parts most luxuriant; and the plains, forests, and rivers alike abound with creatures of strange form—indeed the country teems with life. As at present known, its altitude varies from 1000 to 7000 feet above the level of the ocean. In some parts the coast is skirted by lofty inaccessible cliffs of sandstone and granite, and in others the land, on approaching it from the sea, presents low sandy hillocks clothed with a scanty but peculiar Flora, which in certain latitudes assumes a tropical character. The general aspect of the coast region varies in its features : in some districts it consists of open, thinly wooded country, resembling parks, spreading over luxuriant grassy plains ; other tracts are encumbered with dense forests, in which trees of enormous magnitude prevail, looking from their vastness as if they had been in exist-

ence from the earliest period of the world's history. Amongst them the *Eucalypti* or Gum-trees rear their tapering stems, attaining an immense altitude and great circumference, while Giant Figs of still greater magnitude assume almost fabulous dimensions. From the singular mode of growth of the trees last mentioned, it is indeed difficult to calculate their exact size, on account of the extension of rope-like branches downwards, which gradually embrace the parent stem, until the latter wholly disappears under the layers successively deposited, and becomes the centre of an enormous fluted column of irregular form, supported by huge buttresses, which extend to a great circumference at the base. The Fig, moreover, in Australia, is always conspicuous in the forest scenery from its enormous size, its rounded head, and dark foliage. Beneath the loftier trees the surface of the ground is clothed with a dense underwood or brush, composed of dwarf bushes and shrubs, of genera and species peculiar to the country. The banks of the rivers are fringed with the needle-foliage of the *Casuarinæ* or Australian Firs, of various species, and some of elegant growth. In the rich meadow-like districts, the vivid green of the *Angophoræ* or Apple-trees is displayed to great advantage. Some parts present extensive marsh lands, sterile in aspect, but capable of cultivation for cotton and various valuable tropical products: such localities are seen about the Hunter, Clarence, MacLeay, and other salt-water estuaries, and only require the industry of man and an outlay of capital to render them as productive as similar soils in America and other countries. In scrubby, sandy soil grow the extraordinary *Banksiæ*, or Honeysuckles as they are called, from their flowers yielding a sweet nectar; and the strange-looking *Xanthorrhœæ* or Grass-trees, producing a yellow gum-like secretion, which emits, when burnt, an odour resembling frankincense, are characteristic of Australian scenery.

Immense deltas are formed in certain parts by the floods from the interior, well exemplified by the Murray near its embouchure, spoken of as the Great Murray scrub of South

Australia. Mr. Gould alluding to it says, “This enormous flat, of nearly one hundred miles in length by more than twenty in breadth, is clothed with a vegetation peculiarly its own,—the prevailing trees, which form a belt down the centre, consisting of dwarf *Eucalypti*, while the margins are fringed with shrub-like trees of various kinds. Nor must the immense belts of *Banksiae*, which grow on the sand-hills bordering the sea-coast and in some parts of the interior, or the districts clothed with Grass-trees (*Xanthorrhœa*), be passed over unnoticed.

“In the intertropical regions of Australia, of which at present so little is known, we find, besides the *Eucalypti*, *Banksiae*, and other trees of the southern coast, dense forests of canes, mangroves, &c. Each of these districts has a zoology peculiarly its own : for instance, the *Banksiae* are everywhere tenanted by the true Meliphagous birds ; the *Eucalypti* by the *Trichoglossi* and *Ptiloti* ; the towering Figs by the Regent and Satin birds ; the Palms by the *Carpophagæ* or Fruit-eating Pigeons, and the grassy plains by the Ground Pigeons and Grass Parrakeets. The circumstance of the boles of the trees being destitute of a thick corrugated rind or bark will doubtless account for the total absence of any member of the genus *Picus* or Woodpeckers—a group of birds found in all parts of the world, with the exception of Australia and Polynesia.”

The birds represent many of the types found in Europe ; yet the Australian continent possesses genera exclusively its own, many of which are nocturnal—probably more in proportion than are to be found in any other country. It has been mentioned by Mr. Gould (whose magnificent work on the Birds of Australia has been so valuable a boon to natural history), that a remarkable feature connected with Australian ornithology is “that of its comprising several forms endowed with the power of sustaining and enjoying life without a supply of water—that element without which most creatures languish and die.” For instance, he mentions the Halcyons, which were found “on the parched plains of the interior during the severe drought of 1838–39,

far removed from any water—the food of these birds being insects and lizards. It is not uncommon also,” he continues, “for many of the Australian birds to display an extraordinary fecundity, breeding three or four times in a season, but laying fewer eggs in the early spring, when insect life is less developed, and a greater number later in the season, when the supply of insect food has become more abundant.”

The Parrot tribes here are a very numerous family, perhaps not to be equalled in the world, and form four great groups:—the large Cockatoos (*Calyptorhynchi*), including the large Black Cockatoos, who procure their food from the *Banksiæ*, *Casuarinæ*, or *Eucalypti*; the *Cacatuæ* (Rose and Crimson Crested Cockatoos, &c.), feeding upon the bulbs of plants, more particularly the Orchids; the Honeyeaters (*Trichoglossi*), subsisting upon the nectar extracted from the blossoms of the gum-trees and other flowering trees yielding honey; and the Ground and Grass Parrakeets (King Parrots, Lories, and others), living upon the seeds of various grasses which abound on the plains. Mr. Gould considered the united groups in 1848 amounted to sixty species; but since then he has described so many new Australian forms as to have extended this number very materially.

The larger and typical Gallinaceæ are entirely wanting, being represented by the *Megapodius*, *Talegalla*, and *Leipoa*, all peculiar to Australia: their mode of incubation indicates an inferiority of type; they are excellent eating—preferable to our European game. The Wonga-Wonga among the Pigeon tribe is not less esteemed, its flesh being white, delicate, and of surpassing flavour.

The Mammalia are also different from all those met with in other parts of the globe, and the fossil remains exhibit characters equally extraordinary. The Marsupiata extensively prevail; and the Kangaroos, Wombat, Koala, *Ornithorhynchus*, Echidna, the Thalycine or Devil (peculiar to Tasmania), Phalangers, and Flying Opossums (*Belideus*), constitute a fauna as interesting as it is remarkable.

I believe it was Charles Lamb who said, the peculiarity of the small fore-feet of the Kangaroo seemed to be for picking pockets ; but he forgot to mention the singularity characterizing the animal kingdom of Australia, that they have pockets to be picked, being mostly marsupial. We have often amused ourselves by throwing sugar or bread into the pouch of the Kangaroo, and seen with what delight the animal has picked its own pocket and devoured the contents, searching its bag, like a Highlander his sporran, for more.

The coasts of the Australian continent also abound with interesting marine productions, both vegetable and animal. The Sea-weeds recently described by my friend Professor Harvey in his ‘ *Phycologia Australica, or a History of Australian Sea-weeds,*’ have proved a fertile field of research ; he collected upwards of 600 species of *Algæ* from Western Australia, Victoria, Tasmania, and New South Wales, and estimates the different species of sea-weeds along the Australian coasts at nearly a thousand, of which 800 are already known. Innumerable attractive and, as yet, imperfectly described forms of animal life present themselves, well calculated to arrest the attention of the observant naturalist. In June last, I laid before the Zoological Society drawings of thirty-six species of Nudibranchiate mollusks collected by G. F. Angas, Esq., consisting of *Doris*, *Tritonia*, *Eolis*, &c., the whole of which are new in specific characters, and two no doubt will prove generically distinct ; these were captured in Port Jackson and bays in the vicinity. In the same locality, the elegant *Physalia* or “ Portuguese Man-of-war ” is met with abundantly.

This beautiful genus of the group of Hydrostatic Acalephæ is remarkable for its delicacy of form and brilliancy of colours ; the inflated bladder, glowing in delicate crimson tints, floats upon the waves, whilst the long tentacula, of a deep purple, extend beneath, as snares for capturing its prey. The species now more particularly under observation is the *Holothuria Physalis* of Linnæus, the *Physalia pelagica* of Lamarck. The body of

the animal consists of a horizontal, somewhat oblong bladder filled with air, semipellucid, rounded at one extremity, and with a beak-like projection at the other ; on the summit is a transparent crest or ridge, slightly elevated, sulcated and fringed at the edges, which appears capable of being raised or depressed at will ; the inferior portion of the vesicle is of a light-blue colour, with occasional streaks of delicate sea-green ; the superior part is tinged with a brilliant crimson. These tints, however, are so evanescent, that soon after the animal is removed from its native element the crest sinks, the bright crimson, green, and purple tints fade, and its beauty vanishes. The bladder portion is filled with air. I have often heard it asserted that the creature has the power of collapsing on the approach of storms, and sinking, but on the return of fine weather and gentle breezes re-inflating itself, and sailing about as gaily as before : this assertion, judging from my actual experience and observation of these animals alive, cannot have been made by a practical observer, for on a minute examination no apparatus can be discovered by which such an effect could be produced. I have often observed them in stormy weather turned over by the waves ; but, from the lightness and buoyancy of their structure, they readily resume their natural position, glowing in purple and crimson as beautiful as before. I have even seen these Acalephs thrown in tempestuous weather in heaps upon the beach, in several of the embayed waters of the Australian coast, the whole of them having the bladder still remaining inflated, although all their colour had disappeared, excepting the deep purple of the tentacles.

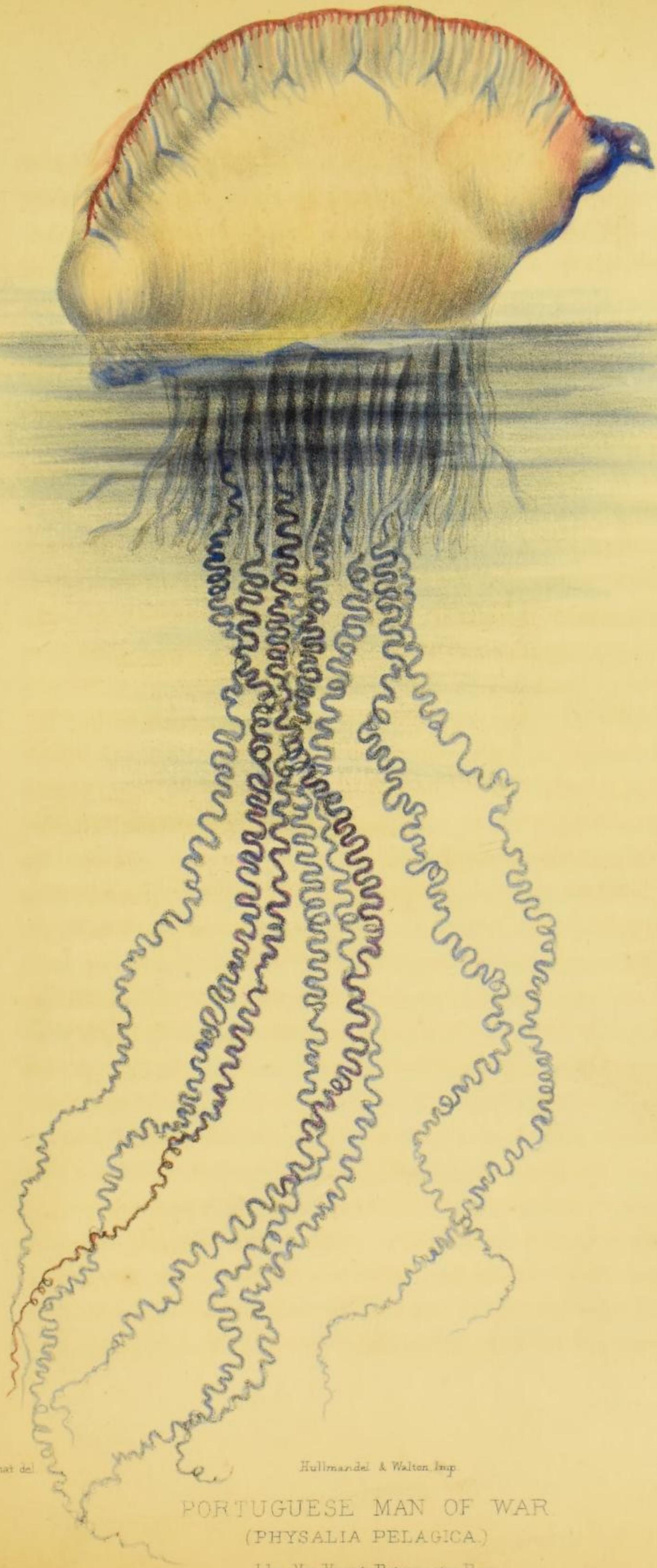
Situated beneath the inflated vesicle of the *Physalia* a dense mass of tentacula is observed, some of which are short and thick, while others are several feet in length ; these are capable of retraction, and also of very great extension. The long tentacula or cables, when minutely examined, seem to consist of a chain of globules filled with a fluid, and they have an oval plate or sucker at the free extremity. In colour they are of a deep

purple, with a faint crimson tint, and secrete a glutinous substance emitting a peculiar faint odour.

It is amusing to observe persons, who, captivated by the beautiful tints, seize this prize, soon drop it on finding the long adhesive appendages tenaciously attached to their hands, inflicting most painful stings—more severe than such a creature could have been supposed capable of producing. On one occasion I tried the experiment of its stinging powers upon myself, intentionally, when, on seizing it by the bladder portion, it raised the long cables by muscular contraction of the bands situated at the base of the feelers, and, entwining the slender appendages about my hand and fingers, inflicted severe and peculiarly pungent pain, adhering most tenaciously at the same time, so as to be extremely difficult of removal. The stinging continued during the whole time that the minutest portion of the tentacula remained adherent to the skin. I soon found that the effects were not merely confined to the acute pungency inflicted, but produced a great degree of constitutional irritation : the pain extended upwards along the arm, increasing not only in extent but in severity, apparently acting along the course of the absorbents, and could only be compared to a severe rheumatic attack ; the pulse was accelerated, and a feverish state of the whole system was produced ; the muscles of the chest even were affected, the same distressing pain being felt on taking a full respiration as obtains in a case of acute rheumatism. The secondary effects were very severe, continuing for nearly three-quarters of an hour ; the duration of the pain being probably longer in consequence of the time and delay occasioned by removing the exciting and virulent tentacula from the skin, as they adhered to it, by the aid of the stinging capsules, with an annoying degree of tenacity. On the whole being removed, the pain began gradually to abate ; but during the day a peculiar numbness was felt, accompanied also by an increased temperature in the limb upon which the stings had been inflicted. For some hours afterwards the skin displayed several white ele-

vations or wheals on the parts stung, similar to those usually seen resulting from the poison of the stinging-nettle. The intensity of the pain depends in some degree upon the size and consequent power of the creature; and after it has been removed from the water for some time, the stinging property, although still continuing to act, is found to have perceptibly diminished. To remove the irritation, at first cold water was applied; but this, instead of alleviating, increased the evil: an application of vinegar relieved the unpleasant symptoms, and olive-oil has produced a similar beneficial effect. I have observed that this irritative power is retained for some weeks after the death of the animal in the vesicles of the cables; and even linen cloth which had been used for wiping off the adhering tentacula, when touched, still retained the pungency, although it had lost the power of producing such violent constitutional irritation.

In the month of April, in lat. $25^{\circ} 3'$ N., long. $20^{\circ} 42'$ W., I captured a large number of the *Physaliæ*, some of which had the crest more elevated than others; and I remarked that the largest and apparently oldest had the crest tinged with a beautiful orange colour, while in smaller and younger specimens it exhibited a rich tint of vivid carmine. The air-bladder, when the animal was just removed from the water, quivered, displaying a contractile muscular power; the beaked or pointed end also had a slight retractile motion; but there was not the least power of collapsing the inflated membrane by expelling the air contained within it. After death the crest shrivelled, the beautiful colours gradually faded away and vanished,—the deep purple of the tentacula alone remaining unchanged until decomposition took place. I am not aware whether the chemical character of the air contained in the inflated membrane has been determined, but it will very probably be found to be similar to that contained in the air-bladder of fishes. The appendages to the vesicle of the *Physalia* are numerous and varied in their forms. Cuvier considers that some may serve for suckers, others may be ovaries, and some, longer than the rest, may be tentacula.



Angas ad nat del

Hullmandel & Walton Imp

Drawn on Stone by W Ragg

PORTEGUESE MAN OF WAR
(PHYSALIA PELAGICA.)

John Van Voorst, Paternoster Row

From my own observation, I found the short appendages were destitute of any stinging property, had suckers on each side, and evidently formed the mouths through which the food was devoured, or rather absorbed.

When a living specimen was placed in a tub of water, these appendages were observed to be in a constant state of agitation, exhibiting a vermicular motion ; and the suckers attached to them were in an active state of contraction and expansion, as if seeking for prey ; whilst at short intervals the long purple feelers were darted out with rapidity to a great distance, perhaps for the purpose of benumbing and capturing any victim that might come within their range *.

Among the shorter tentacula was a cluster or compact mass, of a bluish-pink and greenish colour, of soft consistence, and composed of minute globules mingled with a gelatinous substance, and quite destitute of any pungent or acrid properties. On this portion of the animal were several small inflated bladders, in different stages of formation ; these I considered as offsets or buds (*gemmae*), and in this form the young were observed ready to be cast off from the parent. As I have frequently captured perfect specimens of *Physalia* measuring only $\frac{5}{8}$ ths of an inch in length, and of a proportionate height, I conjecture they are thrown off from the parent in succession as they become sufficiently developed to float about and provide food for themselves. The small *Physalia* had the vesicular portion of the animal destitute of the vivid colours, the cause of so much admiration in the adult ; indeed the tints which adorn it appear to advance in beauty as the animal increases in size, changing in the older specimens, as I have before observed, to a bright orange colour. The long cables or tentacula can be thrown out to a great distance—to twelve and even eighteen feet, and by aid of these the *Physaliæ* are enabled

* The drawing of the *Physalia* given in the accompanying Plate (Pl. II.) was taken from a specimen which measured 5 inches in length and $2\frac{1}{2}$ inches in height.

to capture any small fishes that may come within their reach, which, by the wonderful retractile power of these appendages, are speedily conveyed to the short suckers or mouths, whereby the prey is devoured, apparently by absorption.

This I had an excellent opportunity afforded me of verifying; for having one day captured a specimen in my towing-net, I observed, entangled by the tentacula, some small fishes; among many others was a very small specimen of the *Centronotus niger*, caught in lat. $15^{\circ} 3'$ N., long. $22^{\circ} 12'$ W., the back of which was of a beautiful dark purple, with broad lateral stripes of a deep black colour; abdomen and sides silvery; bases of the pectoral fins purple; dorsal, ventral, anal, and caudal fins more or less tinged with the same colour. On placing them all together in a tub of sea-water, the *Physalia*, being apparently very hungry, immediately seized the fishes entangled in its grasp, and the process of feeding by absorption was distinctly observed. The tubes to which the suckers were attached were soon seen to be filled with portions of the fish, readily to be distinguished through their diaphanous coats by the silvery hue imparted to them; so that they somewhat resembled preparations of the absorbent vessels when injected with mercury, the upper portion being the most distended. I afterwards made a minute dissection for the purpose of ascertaining if the tubes filled with food terminated in any common receptacle, or any organ analogous to a stomach, but no trace of any could be discovered; so that I have arrived at the conclusion that these Acalephs take their food by absorption through these tubes, and that they constitute the only digestive apparatus.

These tubular appendages had their origin from the under portion of the air-bladder by strong muscular fibres, similar to those forming the exterior or fibrous tunic of the air-vessel; and I found the inferior portion of the air-bladder consisted of a denser structure than that of the upper, approximating very closely to a cartilaginous consistence. The long feelers or cables also take their origin from the inferior portion of the bladder by

a broad muscular and very elastic band, which I ascertained was capable of great expansion and contraction in the living animal, exhibiting an elasticity similar to that of a piece of india-rubber.

It is a very interesting sight to observe the action of the tentacles when the *Physalia* is placed in a large tub of sea-water ; for they are then seen to form an admirable organ of prehension, capable of being coiled up with the greatest rapidity to within half an inch of the air-bladder, and then darted out again with a surprising degree of velocity to the distance of several feet, entwining around and numbing prey, so as to render it helpless, and then conveying it to the tubular tentacles or mouths to be devoured. Both the long and the tubular tentacula retain their irritability for some time after they have been removed from their native element. I found, by keeping the specimens alive in a large tub of water, which I did during several days, for the object of observing their natural actions, that they were more formidable enemies than from their simple organization it could be at first supposed ; for their long tentacles, darting out with velocity from the dense and firm floating support of the air-bladder, formed a most adhesive network around their victim, while at the same time any resistance was prevented by the numbing influence. When in the tub of water, I observed there was a constant action of all the tentacles ; the animal, however, appeared to have no voluntary power of locomotion, but was wafted about in obedience to the action of the wind upon the air-vesicle ; still I observed that the crest appeared to be raised or depressed, as if by muscular effort.

I made many attempts, in recently captured specimens, to express the air from the bladder, but found it was impossible ; the only result, on great violence being resorted to, was an explosion : and when kept alive in sea-water they never appeared to have the power of diminishing or increasing the quantity of air in the bladder ; for, from the smallest to the largest, it always continued tensely inflated, and appeared to grow in that

state as the animal increased in size. I found on dissection that the air-vesicle consisted of two coats—the outer dense, possessing longitudinal fibres, the inner resembling cellular membrane both in appearance and consistence. The separation of the coats from each other could be effected with the greatest facility : the inner would, after having been detached from the outer, still remain inflated ; the outer one, on the contrary, collapsed on the separation taking place.

After a minute examination of a great number of specimens, I was unable to detect the orifice usually stated to exist at the pointed end of the bladder.

Having upon one occasion captured a number of large specimens, I made some experiments on the air-bladder. After it had been punctured in all directions, I found only the outer dense and resilient membrane had been penetrated, the inner membrane still continuing inflated. I afterwards divided the pointed end with a pair of scissors, which, severing only the outer elastic coat, left the inner entire. On division, the outer coat displayed great irritability and contractile power. The result of this treatment was the protrusion of the inner inflated membrane—but only in a partial degree, as if the bladder was divided into compartments ; and the animal still floated upon the surface of the water with its usual buoyancy, the crest and upper part having collapsed, the lower and truncated end still remaining as before. On dividing the truncated end, a similar portion of inflated membrane protruded ; and on this being opened the contained air escaped, excepting a very small portion in the central part ; yet even this sufficed to keep the animal in a state of buoyancy. On the remaining portion being opened it collapsed, and the bladder, in shreds, floated upon the surface of the water. Before the last portion of the bladder was divided, the animal did not seem to suffer any inconvenience from the experiment ; for the short tubular tentacles or mouths, and the long cables or feelers, were in a constant state of activity, as if still seeking for prey after their usual manner : but when the

last division of the membranous portion was made, the animal could no longer float near the surface of the water, and the power of action in the whole of the feelers appeared to be entirely lost.

Among the objects of animated nature which attract the notice of the voyager on entering the tropical regions, none has perhaps excited more attention than the Flying-fish (*Exocetus volitans*), which is seen in great numbers about the Australian coasts during the summer months. Many opinions have been given respecting its habits and peculiarity of flight, from the days of the early navigators to the present time. Its flight resembles that of a bird, and it has often been mistaken for such by persons who have seen the creature for the first time, “finning” its flight at sea. Opinions differ relative to the motive which prompts its aerial excursions, some considering that it forsakes its native element for sport and pastime, merely to pass off by excitement a natural liveliness of disposition ; others regard it as the victim of persecution, and in consequence it has the deep sympathy of certain persons, who eat other fishes as food without any particular remorse of conscience ; whilst some pronounce a cooked flying-fish a very palatable dish at sea.

The facts stated are simple enough :—Flying-fish rise in the air, and are generally represented, with much exaggeration, as being immediately attacked by immense flocks of gannets, tropic-birds, frigate-birds, and others of their feathered enemies ; while the few that escape and regain their native element immediately fall into the mouths of the albacores, bonitos, dolphins, and other fishes, who are waiting with expanded jaws, like so many crocodiles, to receive them as they fall,—the only surprise being that the race is not extinct. But I am inclined to be sceptical on this subject ; and, although a hunting-scene may be occasionally observed, yet oftentimes large shoals of these fish may be seen springing from the water, pursued by no fish or bird, but evidently in active chase themselves after their prey,—the aggressors, not the victims. On examination of the contents of the stomachs

of those caught, the remains of small fish, as well as crustacea and mollusks, have generally been found: and this may explain why the supposed war of extermination has not diminished their numbers; for they are observed in as large flocks at the present day as they were in olden times.

It is an agreeable change from the monotony of a voyage, when tired of reading, conversation, chess, and other amusements, to pass the time by watching the flight of these interesting fishes; for some hundreds of miles they may be seen rising in shoals at greater or less distances from the ship, with not the slightest indication of being disturbed by any living enemy in the air above or in the ocean beneath. It is a beautiful sight to observe them on a fine clear day, whilst sailing with the agreeable and steady breezes of the trade-winds, to watch some animating the air and sparkling with silvery brightness, and others rushing from the water with an audible rustling noise as they spread out their large pellucid wings or fins in a new element,—their brilliant purple backs gleaming, and their silvery sides glistening like molten silver under the dazzling light of a tropical sun. Sometimes, but rarely, and then usually when near the land, a scene of excitement occurs:—shoals of the Flying-fish passing near the coasts have been pursued by albicores, dolphins, and bonitos, and when rising to escape have been pounced upon by their winged enemies.

When watching attentively the actions of these fishes, I have observed them pass steadily through the air to the height of from two to four feet (three feet may be considered as the average height they usually attain), and then, gradually falling, they skim nearer the surface—rising, falling, and continuing their career by striking their tails against the water; at other times they spring from the sea to a great elevation, and after taking a flight of from 100 to 160 yards, drop, and renew a shorter flight every time, until they are seen to rise no more. I have known them come on board a ship at a height of from fourteen to seventeen feet.

These fishes have large pectoral fins and the tail as organs of flight, the former being placed near the back, so that the centre of suspension is higher than, and in front of, the centre of gravity.

There is another peculiarity, which I observed and published some years since, but which, on my recent voyage to England, I had an opportunity of again noticing :—the air-bladder extends in this fish from the pharyngeal bones to the extremity of the body, and, when distended, occupies nearly the whole of the cavity of the abdomen. There is also, in addition to this, a continuous membrane in the mouth, near the pharynx, which can be inflated through the gills. The largest portion of the air-sac is nearest to the head, and diminishes gradually as it passes towards the tail. It is considered that a particular purpose is fulfilled by the larger dimensions of the air-bladder near the head, as a compensation for the great weight at this part in consequence of the breadth, required for the support of the animal's body in the air in a favourable position for flight. I am of opinion therefore that, by the aid of the extended pharyngeal and other air-sacs, the specific gravity of this fish can be regulated in correspondence with the element through which it may move,—an analogous power to that conferred by the air-cells so freely distributed in the structure of birds, and, having the additional advantage of being, under the influence of volition, capable of being exercised in both elements with advantage; still such an organization can only afford a temporary support in the air, as the structure of the gills will soon require the Exocetus to seek its native element, after a brief sojourn in one so unsuited to it.

The usual length of this fish is from 10 to 12 inches, but at the Island of St. Helena I have seen it offered for sale from 15 to 20 inches long, where it is used, as in the West Indies, for food, and is of very sweet and delicate flavour. This species is named the Solitary Flying-fish (*Exocetus solitarius*), from not being seen in large flocks like the others; and it appears to have other specific differences.

When watching these fishes closely, as they passed under the

stern of the ship, I remarked that the extension of both the pectoral and ventral fins was effected with an audible rustling noise, and only a vibratory motion was perceptible afterwards ; nor was there any expansion and contraction of those organs during flight, after the first effort. Had there been any percussion of the pectoral fins, it would have been distinctly visible owing to the proximity of the fish ; indeed, to produce percussion of the fins it would be requisite to have an elaborate muscular apparatus ; and as on dissection such is not found, the theory of that action of the fins may be considered unsupported by facts. It was also remarked, that the fish, when keeping in a direct line of flight, proceeded for a great distance ; but when this was deviated from and it turned round (which action was apparently performed by the tail, not by the pectoral fins), it only proceeded about the length of a yard and dropped into the water. The greatest length of time I have seen them fly has been thirty-two seconds, and their longest flight from 200 to 250 yards.

The Flying-fish has a steady flight, resembling that of some birds ; but when pursued by enemies, or frightened by the passage of the ship through the water, it loses this graceful style of volitation, its flight becomes hurried, irregular, stiff and awkward—a kind of scrambling pace, and it frequently drops into the water and again renews its flight in the same unsteady manner.

When a large shoal of them emerged at the same time from the sea, it was perceived that some of them dropped immediately, others passed over a distance of twenty yards and fell, while the rest continued a steady flight of 170 to 200 yards and passed out of sight. Their long pectoral fins or wings have the rays united by a fine delicate membrane, flexible and transparent ; the colour of this membrane varies ; and some have the ventral fins so large as to appear to have four wings. On many occasions Flying-fish and Albicores have been very numerous about the ship, yet, on the capture of the latter, not a single Flying-fish has been found in their stomachs, but a quantity of

the Flying Squid (*Loligo sagittata*) and *Argonauta*, or Paper Nautilus, proving that the Flying-fish is often sufficiently nimble to escape from its voracious enemies. It is not improbable that a casual observer might consider the Albicores, when in chase of the Flying Squid, to be in pursuit of Flying-fish ; and many of the oceanic birds also capture the Flying Squids as they emerge from the water. On several occasions during the night, Flying-fish were caught, having fallen on the deck of the ship—no doubt attracted by the lights in the vessel ; for they are captured by torch-light in the West Indies, where they are extensively used as an article of food.

There is a parasite found in the muscles of the Flying-fish, about an inch or more in length, of a blackish hue, and is a species of *Lernæa*. Some years since, a Flying-fish came on board the ship, at a height of fourteen feet from the water, upon the thorax of which a *Lernæa* was imbedded, and upon its surface was attached a group of Barnacles (*Cirripeda*),—the former deriving its nourishment from the fish, and the latter from the floating organic matter in the water. The preparation having been sent to the Museum of the Royal College of Surgeons of England in 1833, was brought before the notice of the Zoolo-
gical Society in that year by Professor Owen. In July 1858, Mr. W. H. Flower exhibited a Flying-fish to the Zoological Society of London, from the back of which a singular-looking growth protruded. This was also a parasite, a specimen of *Pinellus Blainvillii* (Milne-Edwards, Hist. Nat. des Crustacés), *Leoneopenna Blainvillii* of Lesueur ; it was $2\frac{1}{2}$ inches long ; the head and three horn-like processes were buried in the muscular mass on the right side of the spinal column of the fish ; and the whole of the exposed part gave lodgment to a colony of little Cirripeds, *Conchoderma virgata*, Spengler (Darwin's Monograph of Cirripedia). These were of various sizes, the largest measuring 9 lines in length. When first caught they were all living, and being placed in a basin of sea-water, exhibited beautifully the characteristic motions of the cirri ; while a circulation was

also observed in the Lernead*. This parasite is peculiar to the Flying-fish, and is very often found imbedded in various parts of its body; but Cirripedes are more rarely found upon them.

In lat. $10^{\circ} 12'$ S., long. $30^{\circ} 19'$ W., at daylight, blowing a fresh breeze, a Flying-fish came on board from windward, at a height from the surface of the water of twelve or thirteen feet. It measured $10\frac{1}{2}$ inches in length, and differed from others I have seen in the less divergence and colour of the pectoral fins, and the greater length of the ventral. The pectoral fins on the upper surface were of a purplish colour, gradually diminishing in intensity towards the extremities, which were of a bluish-white. From the sixth ray the centre was white, giving the appearance of a large irregular white spot upon the fins. The under surface of the pectoral fins was of a bluish-white, intermixed with dark shades; the base of the rays silvery. The pectoral fins of this species, when expanded, had not the convexity of form seen in the *Exocetus evolans*. The ventral fins were situated about an inch distant from the anal, and were of a bluish colour, the membranous part of the fin being perfectly colourless and transparent. The tail was of a blue colour, with purple rays. The upper part of the head and back deep purple, diminishing on the side in the deepness of colour, having a faint pinkish tint, mixed with silver, over the abdomen †.

In lat. $28^{\circ} 56'$ S., and long. $39^{\circ} 56'$ E., a Flying-fish was found in the lee quarter boat, which, from its situation, must have flown or leaped a height of full twelve feet above the surface of the water. It was of the following dimensions :—

	inches.
Length from the head to the extremity of the tail	11
Length of the pectoral fin	$6\frac{2}{8}$
Greatest expansion of the pectoral fin	$3\frac{1}{2}$

* Proc. Zool. Soc. 1858, p. 372.

† This species accords the nearest, from the position of the fins, with *E. exiliens* and *E. mesogaster*: like the latter species, the fins are also bluish; but it does not accord with it in general colours, and the ventral fins are longer. There were no scales upon the head.

It differed in many of its characters from any described species. The back was of a deep purple; sides and abdomen silvery. The pectoral fins were of a dark bluish-black above, with an oblique, narrow, nearly transparent band, extending across them. The under surface of these fins was also of a dark bluish-black colour, about a shade lighter than the upper surface. The rays above were of a similar colour to the intervening membrane, but below they were lighter, and had a bluish tint. The ventral fins were situated posteriorly to the middle of the abdomen, and were perfectly transparent, with an irregular and large deep-black spot upon them, which, when they were expanded, had an elegant appearance, contrasted with the beautiful transparent membrane around it. The dorsal fin was also similarly diaphanous, with a large irregular black spot upon it. The anal fin was transparent; the tail dark blue, edged with light black. The black patch on the dorsal fin extended nearly half its length at the posterior part.

Swan, in his 'Hexameron,' printed in 1642, gives the following quaint notice of this fish:—" It is named *Hoga*, and is said to be a fish as big as a mackerell, or (as some say) no bigger than a herring. This fish hath wings, which do not so much help her by flying to escape a farre greater fish, as endanger her to the mercilesse crueltie of another enemie. I mean a certain sea-fowl, which waits but for such an opportunitie to devour her. Neither can it flie high or farre, or longer than her moistened wings keep wet; nor yet swimme very fast, having exchanged finnes for wings. So (saith one) have I seen men thrive worse that have two trades, than such as have been skillfull or thriftie in one."