

Introductory report on the natural history of the pearl oyster of Ceylon.

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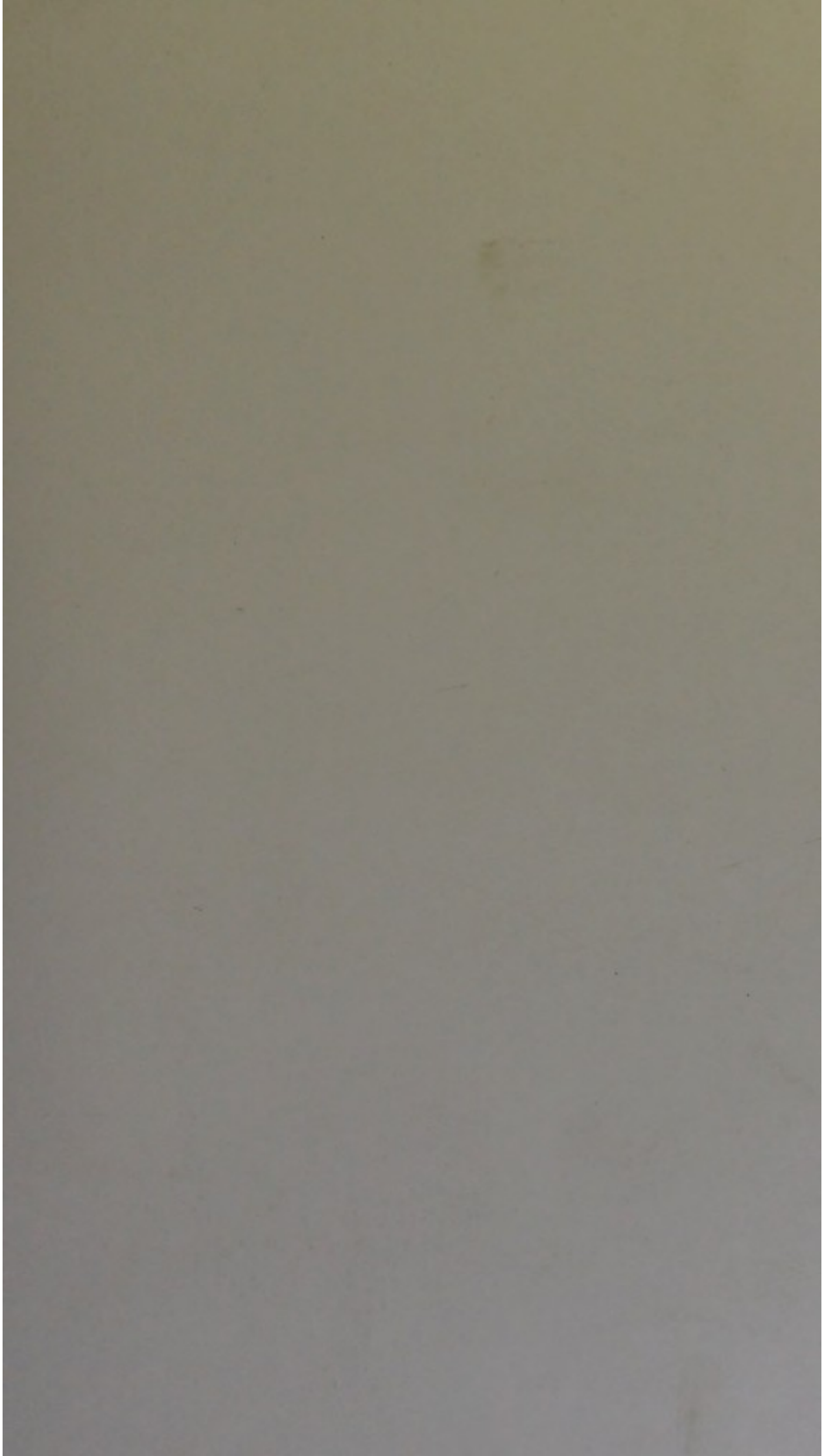
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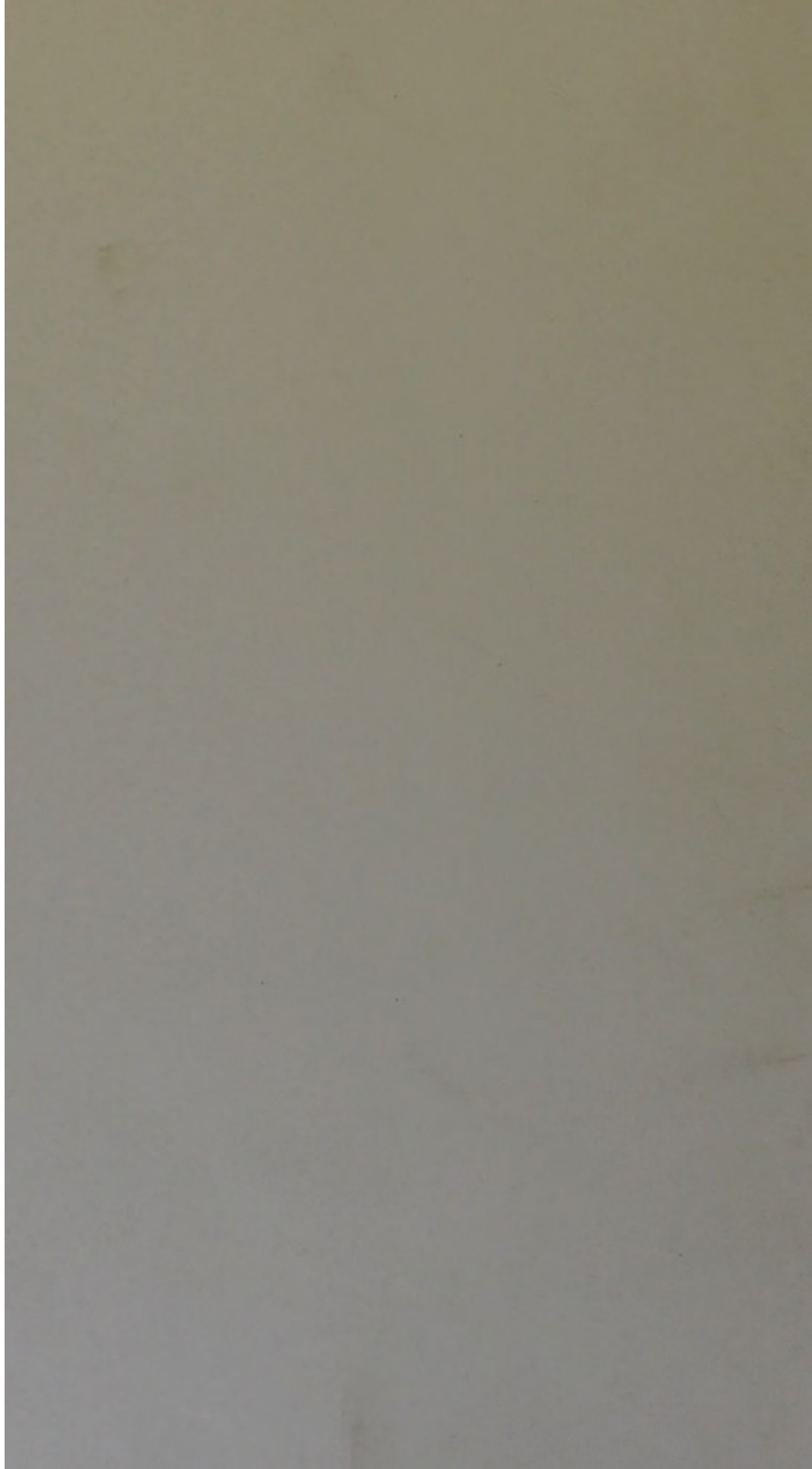
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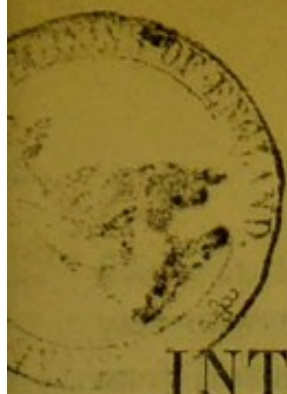
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INTRODUCTORY REPORT
ON THE
NATURAL HISTORY
OF
THE PEARL OYSTER
OF
CEYLON.

1. HAVING understood that some account of my researches into the Natural History of the Pearl Oysters of Ceylon, is desirable, even at this early period of my labours, I shall endeavour briefly to sketch a Report, that can only be considered in the light of an Introduction to a more extensive and prolonged series of observations; which, if means are afforded me, may be brought to a more speedy conclusion than I have any prospect of doing at present.

2. Before I proceed to detail the results of my researches, since I was commissioned by His Excellency the Governor, in March last, to undertake this desirable investigation, I have to acknowledge the great facilities which the *aquarium* gives, for the investigation of the natural habits of Molluscs, and other moderately sized fresh and sea water animals. Without glass aquaria and a powerful microscope, I should not perhaps have obtained even that information on the minute anatomy and habits of the Pearl Oyster, which is embodied in this Introductory Report. Soon after my appointment, I

ordered out large glass aquaria and other apparatus, which will be of service hereafter, to myself, or to those who may be engaged years hence, in reporting to Government, from time to time, the natural condition of the Oysters in their various banks. In the mean time, I have made use of large glass globes and Ceylon manufactured aquaria, made of thick crown glass, roman cement and slate, purchased from the Naval Stores. Large chatties too, and tubs, are also in use. The Oysters thrive best in chatties, but these do not afford the same opportunity of seeing their habits as glass sided aquaria. I have also, in addition to the above named means of observation, had perforated wooden boxes, with a few Oysters in each, deposited in various depths of the sea; and latterly, I have used large canoes (ballams) for the same purpose;—lastly, though perhaps of most importance, I have had unexpected facilities of observation among the several small beds of Oysters, found in the inner Harbour of Trincomalie. They are found of all ages and sizes, at various depths, and different kinds of banks; so that no Naturalist has perhaps ever had the same opportunities of observing the habits of the Pearly Mollusc, as I have at present.

3. I cannot do better, than correct at the outset, some popular errors regarding the anatomy of the Pearl Oyster; and this I may perhaps do most simply, by describing, in a popular form, the external and internal structure of the species of Mollusc producing the best Pearls of Ceylon.

4. The Mollusc, generally known as the Pearl Oyster, found in the Banks of Arripo, Chilaw, Trincomalie Harbour, and other parts of the Island, does not belong to the same *genus* as the edible Oyster of Europe, although, in its internal structure, it has a resemblance to it. The Pearl Mollusc resembles more the Mussel tribe than the Oyster; more particularly, as it has, like the Mussel, a byssus or cable, by which it attaches itself to foreign substances, or to others of

its kind. The only source of information that I know of on this subject, available to the Ceylon student, is to be found in "Lebeck's Account of the Pearl Fishery of Ceylon, 1797," to be seen in the Appendix to Captain Steuart's book. The description Mr. Lebeck gives, is very imperfect, and excites a smile in the modern Naturalist; but this imperfection is excusable, in any account written in the infancy of the science of Conchology, and when the Microscope was scarcely ever applied to anatomical studies of shells; at least not in Ceylon. The most glaring error in that description is the mistaking of "bluish spots" on the foot for "eyes," and the "ovaria" for "lungs." This Mollusc has no eyes; and the lungs, or gills, are in the front, far away from the stomach, and occupy the middle space between the hinge and the anterior edge of the shell, easily seen when the valves are open; they look like four, or two pairs, of whitish (in a few specimens the gills are of a black colour) semi-lunar combs or bands, stretched from side to side.

5. I have carefully examined Oysters of all ages, and have noted the structure of the shell, and of the animal within it; which will form the subject of illustration in a future Report. In this, I shall briefly describe the animal; as it is of the greatest importance, that a correct knowledge be first obtained of the animal structure, before a physiological account of its habits can be properly understood.

Meleagrina margaritifera. Lamarck.

The Pearl Oyster. *Pintadine mèreperle.*

Synonymes. Mootoo Cheepee. *Tamul, Sing.*

Mytilus margaritiferus. Linn.

Margarita sinensis. Leach.

Avicula margaritifera. Roissy.

Avicula meleagrina. Blain.

Avicula margaritifera. Sowerby.

Avicula radiata. Leach.

Conchologists have long agreed, that *Lamarck* was right in separating the "Pearl Oyster," *par excellence*, from the old genus *Avicula*, of which there are several species in Ceylon, some producing valueless pearls of a dusky blue and blackish colour. The only description of the Pearl Oyster of Ceylon I have access to, is Lamarck's, in his "*Histoire Naturelle sans Vertebres*," and that, too, is only of the shell.

"*Meleagrina testa, subquadratâ, supernè rotundatâ, fusco vivente. Albo radiata, lamellis per series longitudinalis imbricatis, superioribus majoribus.*"—Lamarck, vol. 7, p. 107.

6. The Ceylon shell is a variety of that above described. The white radiating lines are alternated with rays of a red or black colour. Doctor Templeton made it appear, that the Ceylon variety corresponded with Leach's description of his *Avicula radiata*. I am more inclined to believe, that they are only accidental or occasional varieties. The shell, however, appears to attain a larger size in America, and in the Persian Gulph, than in the Seas of Ceylon. In the largest Ceylon shells, the red or black radiating lines become obsolete. If they are permanent varieties, they are both found in Ceylon. I have a faint recollection of having seen both varieties on the Pearl banks of Arripo. I had also a small perfectly white Pearl Oyster; this may be an Albino specimen, or Lamarck's *Meleagrina albina*. *M. testâ albidâ, irradiatâ, absolute squamosâ; auriculus duabus semper distinctis*, originally found on the coasts of New Holland and Van Diemen's Land.

On removing the animal from the shell, the whole of the internal parts is seen enveloped in a membrano-muscular covering, called the "*mantle*," and known popularly in Ceylon as the "*skin*." The free border of the mantle lining each valve, dips downwards, to meet a similar veil on the opposite side; thus forming a kind of double fringed veil. The one set of tentacular fringe, in immediate contact with the shell, is composed of hairy tentacles, looking horizontally forwards

the other, about three-eighths of an inch apart from the former, and lining the edge of the mantle, from side to side, looks downwards, and dove-tails with the tentacles of the opposite flap of the mantle. These tentacles consist of a series of long and short flat filaments—the long ones having lateral filamentous projections. The tentacles are exceedingly sensitive; and one would almost give them the power of seeing; for not only the touch of a feather, but the approach of one, when the animal is lively and in good health, makes them draw forwards, and perfectly shut out the intruder. As these molluscs have no organ of sight, I have no doubt that the delicate nerves which are distributed through the mantle and its tentacular processes, possess in some degree the sense answering to vision in other animals, as well as of touch; for an Oyster will be observed rapidly to close its valves on the approach to the aquarium of a lighted candle, or even the approach of a hand, or the shadow of a person, near the glass sides of a vessel in which it is confined. I should not, in a popular Report, advert to this physiological subject, but that the senses of the Oyster have a great deal to do with its habits, not only in the aquarium, but also in its native bed. Were it not for these delicate fringes surrounding the mantle, the softer parts of the Oyster would easily become the food of a host of carnivorous creatures, abounding in the sea; and many more Pearls would drop out of the shell, than do now with such sentinels at the entrance of its external rim. The mantle is the only organ the animal has for the formation of the shell; the increase of the lateral dimensions of which, and the formation of the pearly nacre, and Pearls, depending upon the condition of this important investment. If it is injured, the pearly matter is not secreted in such abundance over the shell, or if, by some cause, it becomes retracted, the shell does not grow rapidly, and the mother-of-pearl lining is jagged at the edge, and is not of the usual brilliant colour. However,

its temporary retraction facilitates the ingress of sand and other irritating particles, which doubtless become the nuclei of many a Pearl, as will be hereafter observed. The forepart of the mantle is coloured and rayed like the shell. The colouring matter is secreted by glands found in these parts. This glandular secretion serves the purpose of increasing the lateral and longitudinal dimensions of the shell. It is after this is deposited, that the pearly secretion (nacre) is applied to the inner wall of the shell, which, concreting or solidifying, increases its thickness. The pearly fluid is secreted by nearly the whole external surface of the mantle. It will be thus clearly understood, that when a grain of sand or the larva of an insect is introduced between the mantle and shell, it will become covered over with the pearly secretion; which always going on, is augmented at the part where the foreign matter lies. This phenomenon I have detected with the aid of the Microscope, in its very earliest stage.

About one and a quarter inch from the rim of the shell, is seen a pair of gills, like four segments of a circle, or semilunar combs, stretching transversely from one side to the other, the convexity looking forwards. There is a vacant space between the concave surface of the gills and the body of the Oyster. The *adductor* muscle, called "*grizzle*," is now seen, covered over with a delicate membrane. This muscle is attached to the inner surface of the both shells. On one side (the left, when the Oyster is placed with the hinge next the observer,) is seen a short, conical, tubular, sharp-pointed prolongation; this is the terminal end of the intestines; it looks like a sharp-pointed claw. The intestine is short; leaving the stomach, it winds round the *adductor* muscle, and terminates, as I have just remarked, on the side opposite to where the mouth is placed. There is always an unclosed space, between the edges of the mantle, when the tentacles are brought together, admitting of the free passage

of excrementitious matter; and it was through the same opening between the mantle, that I observed, on one occasion, the ova escape, in a cloudy stream, which continued to pass into the water for nearly 15 minutes. I failed to detect the immediate part of the animal through which the ova found their exit; and I have not been able to detect a regular oviduct. The ovaria, when distended with ova, cover nearly the whole of the stomach, heart, and liver, and project even on the conical cæcal process of the stomach, and also on the base of the foot. The stomach is very small, placed in the centre of the liver; the œsophagus is very narrow, scarcely admitting a moderate sized probe; it is about 3 lines long. The mouth, situated near the hinge, behind the foot and byssus, is a horizontal slit, of about 3 lines in length, in the duplicature of the lower pair of labial palps. These palps are large, broad, truncated anteriorly, and rounded on the sides; the inner surface plaited, or rather grooved. The sense of feeling, or touch, is no doubt, by this rugose structure, greatly increased. The palps serve the animal as organs of touch, if not of taste; they also serve to collect food, and give the animal the power of rejecting indigestible particles of matter, or such substances as might prove injurious.

I have, through the Microscope, ascertained the kind of food Pearl Oysters live on. This consists of minute algæ or weeds, animalcules and shells, called Foraminifera. *Diatoms* also, those minute vegetable forms which can scarcely be detected with the naked eye, are found growing on the external surface of the shell; where a host of infusorial and microscopical objects likewise find a pasturage. So that the Oyster may be said to carry on its back, the food upon which it lives. The siliceous internal skeletons of these *Diatoms*, I have detected in the excrementitious matter of the Oyster. It will be a subject for future enquiry, whether any of these sharp pointed *skeletons* do not permeate the coats of the

mantle, and thus become nuclei of Pearls. I have, on examination of "seedling" pearls, found the skeleton of a *Navicula*, (species of Diatom) among the *ova*; but whether this proceeded from the stomach of the animal, or got there by passing under the mantle, it was not possible for me to determine.

The Pearl Oyster, like other Bivalves, (Conchiferæ,) are all Monœceous, or rather hermaphrodites; though, properly speaking, they can neither be said to belong to one or two sexes, for, with the exception of the presence of *ovaria* (or egg bags,) no other sexual organ has been yet discovered. Doctor Johnson, in his valuable work on Conchology, remarks on *Conchiferæ*, "that every individual is sufficient to its own felicity." But however correct this may be, regarding the feeling of sexual gratification, it is clearly established by M. Rudolph Wagner, that in some Acephalous bivalves, as likewise in *Tunicata*, *Gasteropods* and *Polyps*, the ovaries of some individuals contain a milky fluid, instead of *ova*; and that this milky fluid contains *spermatozoa*, (seminal animalcules.) I have now to add the Pearl Oyster (*Meleagrina Margaritifera*) as another of the bivalve species of Mollusc, which has individuals with spermatozoa, or seminal fluid, in organs similar to those which in a larger number of individuals contain *ova*, or eggs. It will not, perhaps, be necessary further to discuss this important subject, than to remark, that the Native divers' idea, that, "*there are male and female Pearl Oysters*," is not altogether fabulous. The important part which the male Oyster must play in the formation of banks of Oysters, is self-evident, if it can be clearly established, that the *ova* absolutely require the vivifying influence of a male fluid. I have not seen more than three or four individuals with this milky fluid, in 100 Oysters; nor have I yet satisfactorily made out any difference in the characters of the shells of the two supposed sexes. The Native divers' opinion, quoted by Captain Steuart

and Mr. Lebeck, viz., that "the large flat ones they call males, and those that are thick, concave, and vaulted, they call females or Peedoo Chippy," is not borne out by my microscopical observations. I found well formed ova in Oysters which were broad and flat. It is quite possible, however, that in the course of this investigation, some external marks may be discovered, by which the male Oyster can be distinguished from the female. From the very small number of males (about 3 to 100) to females, I can easily fancy, that if by some natural or artificial cause, the males are destroyed, the banks will not be enlarged; and that in time, they will become extinct; i. e., supposing the majority of Naturalists are correct in their present view of the Dioecious character of Oysters. It is just as likely, that Mr. Garner's opinion will ultimately prevail; viz., "that the organs called *ovaria*, do at certain periods, secrete the seminal fluid, which impregnates the ova contained in them; and is then discharged as an excretion by the oviducts." To this observation of Garner I have to oppose the fact, that not a trace of ova was seen in the ovaria of the supposed male Pearl Oysters, which were distended with the milky fluid at the time when the ovaria of other Oysters were distended with ova.

8. The last, though not the least important part of the animal, is the foot. This important member, which has so many useful services to perform in acephalous molluscs, requires a more than ordinary consideration. It is that long, brown, leech-like member, which is seen when the animal is at rest, coiled up in a corner on the right side, above the byssus, which, when protruding out of the shell, and moving about, gives one the popular idea of a tongue. It is of a dark brown colour above, and whitish beneath; in middle age it is speckled. It is composed of longitudinal and transverse muscular fibres, the latter interlacing between the former, which proceed in two columnar masses

from each side of the *adductor* muscle ; between the bundles of fibres, are placed the abdominal viscera. From its base is sent off, posteriorly, a glistening white fibrous band ; this is attached to the duplicature of the mantle, near the angle of the valves. Thus, the foot is seen to be admirably adapted for locomotive powers ; and also serves, by its connection with the *adductor* muscle, to lengthen or shorten the cable or byssus. The foot, in a full sized Oyster, is about two and a half inches long when extended ; at rest, it is not more than one and a half inch in length. It is broad at the base, tapering to a conical point ; the upper surface is rounded and smooth, the lower flattened and grooved. The groove extending from the base, terminates at the point in an oval cup-like fosset. This groove is lined by a secreting membrane, and is an exact mould for the formation of the byssus, at the will of the animal. When it finds a necessity for making one, the foot is protruded out of the shell, and with the tip it seeks out a spot, where it can rest the terminal disc of the groove. If not satisfied with the substance or position of the stone or any other matter on which it rests, it removes to another more suitable spot ; for a few minutes (say five or six, if the animal is strong) it rests, and is then retracted within the shell, leaving behind a strong fibre with an oval disc, of the form of the groove in the foot. This whitish fibre is attached to the base of the foot at one end, and to the rock, or to the shell of another oyster, at the other. In a day or two, this fibre becomes of a bronzed greenish colour, and looks like hair, with a broad flattened oval root attached to the rock. This process is again and again repeated, at intervals of a few minutes, till a sufficiently strong cable is formed. In a large Oyster, removed from the sea, upwards of fifty such fibres form a thick strong cable or byssus, which is attached to the base of the foot by a bifurcated fleshy root. The animal cannot detach the byssus from

the rock to which it is attached, but it has the power of casting it off its own body and leaving it behind, (like a ship letting slip her cable and anchor in a storm, and sailing off to sea) in order to make another byssus, either on the same rock, or on any other convenient place.

I observed all this process in the aquarium, at a very early period of my investigations; and was not surprised to find, that the Pearl Oyster having nearly the same organs as the Mussel, should form and reform its byssus. But I was agreeably satisfied in learning by these observations, that Captain Steuart, in his valuable and interesting Monograph on the Pearl Fisheries of Ceylon, was incorrect in denying to the Pearl Oyster this faculty. He states, that "*it is not believed that Pearl Oysters have the power to detach themselves, or to remove at their own will.*" I have not only satisfied myself, and many friends who have seen the Oysters in the aquaria which I have established, that the Pearl Oyster can detach or unmoor itself, but likewise that it walks away with its foot foremost, and the shell behind; and does not, as Captain Steuart observes, "*move with its hinges in advance.*" This "shuffling" movement alone attracted Captain Steuart's attention, but it is an unimportant one; as all bivalves without a byssus have it, and it is independent of the will of the animal, owing to the valves being opened and closed for the purpose of respiration. How imperfect must Captain Steuart, a candid inquirer, now say, have been his long observations, when the Oyster is seen, night after night, taking a walk round the inside of a chatty, or mounting the glass side of a vivarium, forming, here and there, a byssus. It is most unfortunate, that he and others should not have made these observations, which are so simple in their nature, but yet conclusive of the possibility "*of translating Pearl Oysters from their original rocky beds to other more convenient locations.*"

Who can tell what the results might have been, had Dr. Wright's views been carried out? I know of my medical brother's Report (made I believe in 1803), only from the brief notice taken of it in Mr. Boyd's observations, and quoted by Captain Steuart, in the Appendix to his work (page 53). Mr. Boyd's observations clearly indicate, that Dr. Wright proposed, some thirty years ago, the transplanting the animals to places convenient for fishing them, when they arrive at maturity. Either Dr. Wright did not observe the facility with which the Oyster reforms its byssus; or he was misunderstood by Mr. Boyd, who remarks further on, "that surely as the animal has not the power of regaining its adhesion, after it is once detached, it cannot, when once broken away from its attachment, fix itself again, and must either perish, or be carried away by the current."

Now, it is very gratifying to me to be able to speak positively on this subject; and this I do hopefully, as I have observed the Pearl Oyster detaching itself spontaneously from its old moorings, in a glass vivarium, and attaching itself to another part of the glass vessel, not once only; but have noticed, that some Oysters will go through this process a dozen times, in less than a month. In addition to the above related facts, I have successfully established a colony of Pearl Oysters near Fort Frederick, in the open sea, at various depths; and have also Oysters which have been living for several months in wooden boxes, finger glasses, glass globes, chatties, and large canoes, sunk in the sea. Some were thrown into the sea, after being removed from the inner harbour and kept in my house in chatties and tubs for two and three days. The byssus of most of them had been broken and torn from the rock. These they have cast off, and are now living attached to each other, and to pieces of coral, and to rocks, exposed to all the influences of the sea.

9. When an Oyster is first put into a vivarium, it sickens,

i. e., the mantle becomes retracted, and a collapse is observed;— in a few hours it revives, but, with few exceptions, it is on the third or fourth day, that the portion of byssus attached to the foot of the animal is shaken or cast off, and the animal puts out its foot and forms another near the spot where it lies; or walks, by a snail-like motion of its foot, to, or up the side of the glass, to the level of the water, and there fixes itself. Some of the Oysters which were thrown into the sea, are now seen growing on the sides of rocks, four and five feet from the bottom.

I am not surprised at these results, for the edible Oysters, without a byssus, have been known for ages to bear transplanting with advantage. If Oysters in artificial beds in England can live and breed, I see no reason why the Pearl Oyster should not do the same, and, like the edible Oyster, yield a large revenue; or prove remunerative to private individuals, who may undertake the establishment of new banks.

10. I have one other subject, connected with the interior economy of the Pearl Oyster, to report upon; and which the microscope which Government aided me in procuring, has enabled me to investigate very satisfactorily.

My observations commenced about the middle of March last; although I was not officially connected with the Ceylon Government till the first of May. I have ever since made monthly observations regarding the fecundation of Oysters; with the following results. In March, and all through April, May and June, every Oyster I opened, young and old, contained ova in the ovaria, except the few which had the seminal milky fluid; so that the *Meleagrina*, like the edible Oyster is in spawn almost from its birth. A precocity serving a useful purpose no doubt; and its practical bearing easily understood. From July to the present date, the Oysters examined did not all contain ova; some of the ovaria were only half full; others contained a very small quantity. It will be very

interesting to proceed with these monthly examinations, and to ascertain, whether the Oyster is only in spawn at certain periods of the year; and, if possible, to determine whether it spawns more than once in twelve-months. Nearly all the 100 Oysters from the Pearl Banks of Arripo, kindly sent to me by Mr. Vane, contained ova, their form preserved, although saturated with arrack. Under the microscope the ovum is seen to be pear-shaped; each measured $\frac{3}{1000}$ part of an inch in diameter, at its broadest part; longitudinally it is $\frac{6}{1000}$ with a short pedicle attached. I have calculated, with the micrometer, the number of eggs contained in the ovaria of an Oyster of five or six years of age, and I find that there cannot be less than twelve millions. Leuwenhook states, that ten million eggs exists in one European edible Oyster. If we consider how few of these millions of eggs can arrive at the mature condition of a living Oyster, and the great demand that man makes upon the species for his gratification; we can only see in this great fact, the bountiful provision made by the Creator for a wise and beneficial purpose.

11. In concluding this first Report, I shall briefly recapitulate the important discoveries I have already made.

1st. The Pearl Oyster is more tenacious of life, than any bivalve Mollusc I am acquainted with. It can live even in brackish water, and in places so shallow, that it must be exposed for three or four hours daily to the sun, and other atmospheric influences.

2nd. That it has locomotive powers, beyond any idea which can be formed from former observations.

3rd. That the power of moving from place to place, is inherent, and absolutely necessary, in early life, for the due performance of the animal functions. This is obvious from the fact, that if a cluster of young Oysters stayed permanently in one place, adhering to each other, the growth of the animal, and particularly of its shell, would be prevented.

4th. That the Pearl Oyster will move about in search of food, if the locality in which it is originally placed is not rich in its natural supplies.

5th. That it will move from its original situation, if the water becomes impure, either from the decomposition of vegetable or animal matter, or muddy; and, probably too, if there is a large influx of fresh water.

6th. That if the water is agitated to an inordinate degree, the Oyster will leave its old mooring place and seek another.

7th. That a thunder storm will kill some in an aquarium. (Query, if thunder storms have similar fatal effects on Oysters lying deep in the sea?)

8th. That the animal can unfix itself from its byssus; and that crabs, shrimps, and other creatures, force them to form a new byssus, by nibbling through the old one.

9th. That it can re-form its byssus at pleasure, if in good health and condition.

10th. That it can live for a long time, without forming a byssus; and that it will re-form a byssus when it has recovered its strength.

11th. That the power of re-forming its byssus, is not confined to the young animal; but that the largest living Oyster I have seen, can re-form it in an aquarium, as well as in the depths of the sea, but not so actively as the young and middle aged.

12th. Pearl Oysters are gregarious in their habits. In placing several young Oysters in different parts of an aquarium, they will sooner or later be found attached to each other. The older ones have also this desire; but their heavy shells impede their motion, and they are contented to remain apart from their fellows.

13th. That taking the foregoing facts into account, there appears to be no reason why Pearl Oysters should not be translated from their native beds, and made to colonize other parts of the sea.

14th. that the young, as well as the old, are in spawn from March to September; and that probably there is no stated period for spawning.

15th. The whole occupation of the Oyster, when fixed to a spot, appears to be, keeping its valves open, and admitting food to its mouth. For several hours the valves remain open, they then close for a few minutes, or for an hour or two, then open again. At night, the valves remain generally open till towards daylight, when they close, and remain so till the sun shines brightly over the horizon. It is during the early part of the night, or soon after sunset, that they exercise, *when required*, their locomotive powers. I have watched the Oysters in aquaria for nearly a whole night; and they appear to be then active in moving and attaching themselves to new localities. During the day, I have only seen, on one occasion, an Oyster form a new byssus. This nocturnal habit, is doubtless an instinctive precaution; for should Oysters move during the day, they are more likely to become the food of fishes, and other animals which prey upon them. Their movements are instinctive, and guided by the sense of touch. Darkness suits them better than daylight, of the difference of which they are very sensitive.

16th. Most of the Oysters in which I have found Pearls, had external marks of having been retarded in their lateral growth, and displaced in early life from their fixed position on a bank. I am inclined to believe, that Oysters which have abundance of food, and are not disturbed, remain fixed for the last two or three years of their growth to one spot. These are less likely to have a large proportion of pearl bearing individuals among them. This of course requires more extensive practical observation, either on the beds in the harbour of Trincomalie, or on the Pearl banks of Arripo.

17th. With reference to the formation of Pearls, I have nothing new to add to the accounts found in the best modern

books on the subject; except that one, which modifies the view taken by Sir E. Home; viz. that Pearls are formed from abortive ova. I believe the ova left behind in the ovaria, are not the nuclei of Pearls, but that the ova which escape through the distended coats of an overgrown ovarium, and are imbedded in the interstices of the mantle, become nuclei of Pearls formed in this situation. I have repeatedly examined seed, or young pearls, in process of formation; and with a magnifying power of 1-5 inch lens, I was able to see distinctly, the outlines of two and three ova through the first or superficial layer of nacre, surrounded by groups of ova. It can be readily understood how an overcharged ovarium will, by some accident, or spontaneous evolution, have its coats ruptured, allowing the ova to escape and become inserted in the contiguous attenuated parts of the mantle. As Pearls are more usually found imbedded in the mantle near the hinge, the most likely place where the ovarium is liable to rupture, I consider this very conclusive of the new theory I have here proposed. I may also observe, that I have seen the vestiges, or cicatrices, in the mantle where the Pearls once existed. Though Pearls originate in the mantle, when large they work their way out, and lie loose between it and the shell; or become attached to the "Mother-of-pearl" surface of the latter. I have no doubt that Pearls can work their way out from this position, and be found entangled in the meshes of the byssus. I also consider it very possible, that an over-distended ovarium is one of the causes of Pearls being discharged from the Oyster and lost. If this be really the case, it will easily account for the singular fact, that a sample of Oysters, fished in the month of October, will yield a larger proportion of Pearls, than a batch of Oysters fished from the same bank in the months of April and May of the following year. These observations are somewhat suggestive, and can be improved upon by future investigation.

12. I have now drawn to a conclusion this Report, which, I fear, has extended to a greater length than will suit the patience of the reader. But the subject being one which has been so long neglected and so little understood, I hope that the Government which has engaged my services, if they do not consider my endeavours as already productive of some practical results, will, at least, see in these researches, glimpses of future success. It is due to Sir Henry Ward, here to acknowledge my grateful thanks, in which my brother Naturalists in all parts of the world, will, I am sure, join, for the gracious manner in which my humble services have been retained, for investigating, fundamentally and practically, the Natural History of a species of Shells, which from the darkest ages of the world to the present, has been considered of inestimable value in producing one of the richest of gems. Time was, when the product of Pearl Oyster fisheries founded Cities in South America and the Red Sea. But what is the state of the Islands of the Red Sea, "whose merchants were Princes"?—They are now thinly inhabited by a miserable race of fishermen. The sites of some of the Oyster banks in South America are not even now known; they have been destroyed by being overfished. New beds are doubtless forming in localities to be yet known to future generations. Ceylon Pearl banks were once on the point of sinking into the same fate, but for the subsequent observance of more caution. I was present at two of the largest fisheries ever made off Arripo in 1835 and 1836. The Oysters fished during the first half of the fishery were full sized, and yielded a good price, most of the speculators making handsome profits. Government was encouraged to pursue the fishery; young Oysters were taken up; many of the purchasers, inflated with former gains, purchased readily, and were ruined; and, I believe, to this day, these over, or prematurely, fished banks, have not been very productive; although twenty

years have since elapsed. If the same incautious and unscientific plan were adopted on the Oyster banks in England, similar results would soon be perceived there. Not a "native" would be had in London, nor even a cultivated one seen any were. If Government desires to have a steady, and not a precarious revenue, from Pearl Oyster fisheries, let good laws protect the beds already known, and those that are now forming; and let means be adopted to secure their increase and growth. In one year more Oysters are consumed in England, than were fished on the banks of Arripo last year; and this consumption is repeated year after year, without exhaustion; simply because the natural laws having been once found out, they are allowed to operate fairly. It will indeed be a very great source of satisfaction to me, if any of the natural laws I have described in this Report, suggest to Government, an improved system of management.

13. My attention has also been directed to the Natural History of the Tamblegam Oyster, *Placuna placenta*. I have a few still alive, which were translated in May last. If this Oyster can be successfully translated, the whole of Batticaloa lake might be converted into a large Ostrearium. The *Placuna placenta* has no byssus, and can, therefore, be more readily transported. Their removal from their native beds, does not necessarily destroy the internal parts. About one-third of the Pearl Oyster *Meleagrina*, die from being injured by the force necessarily applied when detaching them from the rocks to which they adhere.

14. I have also lately "doctored" some Pearl Oysters, according to the plan adopted by the Chinese, in the case of the large fresh water mussel; but which method, I believe, has never been attempted with the real Pearl Oysters. Time, and further experience, are required, to ascertain the results of this practice in Ceylon. Dr. Gray, of the British Museum,

has, I believe, by the application of the same means, succeeded in producing Pearls in the edible Mussel or Oyster of England. It may therefore be hoped, that I shall eventually succeed with the Pearl Oyster of Ceylon. All that I can at present say, is, that they do not die under the operation, and that they are still living, having also reformed new byssuses. This is the only way the period required for the formation of good sized Pearls can be ascertained. There are some other points in the natural habits of the Pearl Oyster, which I reserve for future Reports; as precipitate conclusions may mislead the Government.

Trincomalie,
24th September, 1857.

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