Ciliary Mechanisms in *Aurelia aurita*

DURING the last two years attempts have been made to review the work of Widmark[1], Gemmill[2], and Orton[3] on the ciliation and mode of feeding in *Aurelia aurita* (Linné). The investigations have not been completed owing to the difficulty in obtaining healthy living material, which is essential for a study of this kind; but certain important features have been established and are worth recording in view of the apparently contradictory accounts in the literature.

Widmark's description[1] of the internal ciliation and Orton's[3] of the external ciliation in the adult *Aurelia* have both been confirmed essentially and make a connected story. The most interesting fact is the occurrence of two well-defined ciliated tracts, beating simultaneously in opposite directions, on the inner ventrally directed surfaces of the oral arms; these tracts are (*a*) the basal, forming a median ciliated groove in the angle between the two inner faces of each arm, and (*b*) the sub-marginal, composed of the two ciliated lateral inner faces in apposition. In the adult, the two inner faces are normally closely apposed, separation being partly prevented by the cartilaginous nature of the mesoglœa.

The cilia of the basal tract beat away from the mouth, towards the distal tip of the arm; those of the sub-marginal tract beat towards the mouth. A good preparation can be made to show these tracts by cutting off an oral arm and adding carmine suspension to the cut end of the basal tract while feeding coarse plankton to the distal tip. Both tracts can be seen in this way to be operating simultaneously.

Thus, in the adult *Aurelia*, plankton is collected in the sub-marginal tracts of the oral arms from various sources[3], passed along the arms to the mouth, proceeding by way of the gastrogenital canals to the gastric pouches, where the food undergoes some digestion. From the gastric pouches the food is distributed to the internal canals by the currents described by Widmark[1]. Excretory products and indigestible matter are collected by (*a*) the per-radial canals, and (*b*) the inter-radial and lateral gastro-oral arm canals, which deliver them to the origins of the oral arm basal tracts. In the basal tracts the excreted material passes to the exterior.

The full purpose of the lateral gastro-oral arm canals will not be made clear until healthy, growing and sexually mature *Aurelia* can be examined in the laboratory.

Confirmation has been obtained of the following observations: (*a*) the ciliation of the ex-umbral surface of the adult *Aurelia* and the transference of carmine particles by cilia from the ex-umbral surface and between the lappets into the circular food groove and thence to the food pouches[3]; (*b*) the ciliation of the sub-umbral surface and the transference of carmine particles by cilia from the sub-umbral surface to the circular food groove and food pouches; (*c*) combined ciliary and macrophagic feeding in the ephyra and young stages, as shown by Gemmill[2] and Lebour[4]. It has also been found that the outer dorsally directed surfaces of the oral arms have cilia beating towards the marginal tentacles, that mucus production is of great importance in food collection and food transport, and that there are indications of *p*H control of mucus viscosity[5].

In the growth of *Aurelia* from the ephyra to the adult, the originally wide communication between the mouth and gastric pouches becomes restricted finally to four narrow canals. In correlation with this are the observations of macrophagy in the early stages[2,4], with a probable restriction to an entirely planktonic diet in the later stages[3].

The studies are being continued and will be completed and published in detail elsewhere. I am greatly indebted to Prof. J. H. Orton for much guidance and assistance in these investigations.

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Weight, etc., of Elephant Seal

THERE were recently killed in South Georgia twenty elephant seals, for special examination as to production of oil and meat and bone meal. By the courtesy of Messrs. Christian Salvesen and Co., of Leith, I am able to publish the following figures relating to the experiment.

Of special interest was the weighing of an entire animal in pieces. The total weight was 4,357 lb., and the blood, much of which would be lost, was estimated at 218 lb., almost exactly 5 per cent.

Length: 13 ft. 4 in., presumably nose to tail.

	Lb.	Percentage of total
Skin	265	6·10
Blubber	1469	33·70
Meat	923	21·19
Bone	688	15·79
Flippers, fore	174	3·98
,, hind	70	1·61
Head	114	2·62
Heart	20	0·46
Liver	110	2·53
Spleen	25	0·58
Lungs	90	2·06
Kidneys	14	0·32
Stomach	72	1·65
Intestines	90	2·06
Tongue	15	0·35
Blood (calculated)	218	5·00
	4357	100·00

The fore flippers include shoulder-blade. Stomach and intestines were quite empty.

Composition of tissues

	Blubber	Meat	Bone	Stomach	Intestine
Moisture (per cent)	13·0	71·2	43·2	79·8	80·1
Oil (per cent)	84·0	2·1	19·5	0·2	0·4
Solids (per cent)	3·0	26·7	37·3	20·0	19·5

	Lungs	Heart	Kidneys	Tongue	Liver
Moisture (per cent)	80·3	73·8	77·8	61·5	72·0
Oil (per cent)	0·7	0·5	0·3	21·8	1·4
Solids (per cent)	19·0	25·7	21·9	17·7	26·6

The twenty animals produced averages of 1·8 barrels of oil from the blubber and 0·45 barrels from the carcases, 2·25 barrels or 90 gallons (1 barrel = 40 gallons) per seal.

Meat and bone meal from the residues amounted to 1,625 kgm. Analysis of this product gave the following result:

Moisture	4·7 per cent
Oil	18·6 ,,
Protein	58·8 ,,
Tricalcium phosphate	17·1 ,,
	99·2 ,,

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