Zoologischer Anzeiger

herausgegeben

von Prof. J. Victor Carus in Leipzig.

Zugleich

Organ der Deutschen Zoologischen Gesellschaft.

Verlag von Wilhelm Engelmann in Leipzig.

XXI. Band. 26. September 1898. No. 569.

I. Wissenschaftliche Mittheilungen.

1. Do Salmon feed in Fresh Water? The Question as viewed from the Histological Characters of the Gut.

By Alex. Brown, M.B., D.Sc., M.A., Lecturer in Zoology, University of Aberdeen.

(Schluß.)

The material upon which I have had the opportunity of working was obtained from the rivers Dee and Don in Aberdeenshire and from the neighbouring Coast. At considerable trouble, specimens were procured at different parts of the rivers, at all seasons, and with the genital organs in various stages in development. My observations were commenced in the middle of the year 1895, and extended over the two following years.

For convenience in description, I shall for the most part contrast the characters of the gut in salmon, which are feeding actively in the sea and whose genital organs are in an early stage of development, with those in salmon which have been in the river for some time, and whose genital products have almost matured. By this method the changes in the structural characters of the gut will become most apparent.

1) The General Appearance of the Digestive Organs.

From the distended comparatively thin-walled organ found in the salmon in the sea, the stomach of the river salmon becomes contracted into a narrow tube, thick-walled, and somewhat translucent, so that the gastric rugae are visible through its walls. The large quantities of fat stored up around the pyloric appendages and intestine in the sea tend to disappear in the river salmon. The liver loses its soft spongy consistence while the bile assumes a more viscid character.

2) The Contents of the Gut.

a) In sea salmon. — In sea salmon at all seasons the gut is frequently found to contain partly digested food materials or indigestible substances along with large quantities of fluid. In the stomach the fluid is almost always comparatively clear and is intensely acid. When not in process of digesting food, the stomachic mucous membrane gives a neutral or even faintly alkaline reaction, the alkalinity being in all probability due to the presence of mucin. In the pyloric appendages and intestine (in both of which absorption occurs) the fluid contents are tinged with bile or lipochromes from the food. On no occasion have I found in the pyloric appendages any yellow pultaceous matter except as the result of post-mortem digestion. In the intestine large quantities of crystals of carbonate of lime are generally present due to the limy skeletons of the Annimals used as food.

b) In river salmon. — I have not been able to find any distinct remains of undigested food which are visible to the unaided eye, though there is often clear evidence that food has been recently ingested. In the stomach I have on several occasions obtained an acid reaction, in one case where the genital products (ova) were far advanced in maturity (the yolk spherules of the ova having already partly fused). Save for certain vegetable substances and some parasites, only a clear viscid substance was present in the stomachs of all fishes examined. The intestine in all cases contained more or less of an orange colored substance, semi-solid and viscid in character, and very abundant in the duodenum and rectum. The absence of fluidity is evidently due to the syruppy character of the bile and the diminished exudation of watery fluid from the mucous membrane.

This orange colored material contains mucin, fats, leucin crystals (often in great abundance), tyrosin, crystals of carbonate of lime, bile-pigments, cholesterin crystals, a small amount of cellular debris, and certain other small particles which are almost certainly remnants of food materials. As for the pyloric appendages, when they are cut up in the fresh state, no creamy or pus-like substance has ever been observed in their interior by me (except in those cases examined more than 30 min. or so after death). A small quantity of the same material as occupies the lumen of the intestine is frequently found in some of the appendages, but just as often nothing of this sort is observed save that the epithelial lining exhibits a yellow tinge of bile.

3) The micro-structure of the walls of the Gut.

I do not purpose in this paper to give an account of the structure of the walls of the gut, but merely to refer to those parts which are implicated in the changes brought about by the different conditions to which the salmon is exposed during its migration.

a) The epithelium of the Gut. — Dr. Gulland affirms that the whole lining membrane of the gut undergoes a desquamative catarrh. This catarrh begins in the pyloric appendages and intestine, and afterwards extends to the stomach. »On opening either of these structures (i. e. the appendages and intestine) in the fresh state«, he says, »there is always in the lumen a semifluid pultaceous mass varying in consistence between jelly and pus and more or less yellow in colour. This is the case alike is the salmon from the river mouth, from the upper reaches, and from the sea. . . . On microscopic examination of the appendages and intestine of the salmon«, he continues, »it is found that the pus-like material is due to a desquamative catarrh exactly like that found in the stomach. The mass in the tube is made up mainly of rounded cells staining deeply with eosin, and having their nuclei rounded, somewhat varying in size, but always staining deeply and uniformly with haematoxylin ... The main mass of cells is certainly derived from the degeneration of the columnar epithelium which in these cases is shed almost entirely from the folds of the mucous membrane. . . . I have never found a salmon in the intestine and pyloric appendages of which (for the two are always at the same stage of the process, another proof of their identity in function) this change was not present to a greater or less extent . . . In all fish from the higher reaches, from the sea, and in the kelts from the river, the change was complete. It is very curious to see the connective tissue frame-work of the folds, with its bloodvessels much congested as a rule, lying absolutely bare of epithelium in this pus-like mass«.

Dr. Gulland further finds that the same catarrhal changes affect the gastric epithelium, in which case the superficial cells are the first to be cast off.

As the results of prolonged investigations, in absolutely no case have I found any trace of such desquamative catarrh of the mucous membrane of the gut. The whole process as described by Dr. Gulland is due to post-mortem changes as I have found on trial. He evidently has not been able to obtain his material in a suitable condition — a matter of no little trouble and difficulty. Indeed, at first, such a catarrh of the digestive tract suggested itself to me, but after proper precautions were taken, I was at once convinced that no such thing existed. It his, as I have already said, absolutely essential to cut open all parts of the gut, including the pyloric appendages, and to place them in the fixing fluid, immediately after capture at sea or at the river side. Dr. Gulland says, that in certain Berwick specimens fixed immediately after death in sublimate, the conditions were the same as described above by him. I cannot but think that in these cases there must have been some slip in the preparations, or that there may have been some little delay in fixing the specimens, for one has to remember that a period of 30 minutes or even less is often quite sufficient to bring about autodigestion in at least the pyloric appendages of the Salmon.

Post-mortem digestion in the appendages and intestine is an alkaline one, and is effected by the action of the pancreatic secretion. In trout autodigestion in these structures is comparatively slow. On one occasion in the case of some trout taken from the river Dee which were dying from the effects of alkalis issuing from a neighbouring paper mill, I found that in a very short period after death — one to two hours — the pyloric appendages had suffered post-mortem digestion to an enormous extent, while that part of the body wall lying adjacent had been eroded right through. The trout, as the contents of their stomachs showed, were feeding voraciously. Such an occurrence is not found in ordinary healthy trout as every one knows, while it indicates in some measure how a difference in the amount of alkali present can alter the character of the digestive secretion. Because of the identity of structure in the digestive canals of the salmon and the trout, Dr. Gulland concludes that their functional properties are also identical. It is quite true that for such reasons the functions in both may be the same in kind, but is it so easy to determine identity in degree of function?

But though there is no such thing as the occurrence of desquamative catarrh in the gut of the salmon, there do exist certain changes of importance. These I shall at present briefly refer to, a fuller description being reserved for a future paper.

In the stomach of the river salmon the epithelium undergoes interesting changes in its character. The glandular layer is much reduced in thickness owing to the diminution in size of the component cells. The deeper cells of the cardiac glands are smaller and more granular, while the more superficial cells and the cells of the pyloric glands are also smaller and possess more shallow mucigen cups than those in the sea salmon. As a consequence the lumen of the gastric gland becomes very distinct, whereas in the sea salmon it is obliterated by the large and swollen glandular cells.

In the intestine and pyloric appendages of the river salmon the epithelial cells as a whole become more granular than those in the sea salmon, and in many cases, though by no means in all, the calice cells tend to disappear.

b) The Sub-epithelial Connective Tissue and Stratum compactum.

The only point that need be mentioned at present with regard to these structures is the fact that the sub-epithelial connective tissue layer in the stomach of the river salmon increases in thickness, while the stratum compactum sharing in the same increase becomes more contorted than in the stomach of the sea salmon. This increase, however, is probably only apparent, and is in reality due to the constriction of the walls of the gut.

c) The Absorption of Fat as revealed by microscopic examination.

The process of fat absorption occurs solely in the pyloric appendages and intestine. With the necessary microscopic methods (which I need not here detail), it is very easy to demonstrate the paths traversed by the fat particles in their passage from the absorptive surface into the walls of the gut. These methods and the results they bring will be communicated in a future paper by Mr. R. Glegg, B.Sc., and myself. Briefly the appearances presented are as follows:

In the connective tissue forming the frame-work of the ridges of the pyloric appendages and intestine, there occur a large number of cells in each of which is situated a smaller or larger globule of fat. The nucleus of the cell is spindle-shaped or oval and is pressed to the side of the cell along with the cytoplasm. Thus, in the centre of the ridges and extending a little way into the connective tissue below the level of the epithelial folds, there is found to exist a form of adipose tissue. Along with such, there is always a greater or less amount of ordinary fibrous tissue. Further, the connective tissue below the level of the epithelial folds is crowded with leucocytes of the large eosinophile variety in all of which may be seen numerous small particles of fat, which they are bearing towards the general lymph stream. Leucocytes of the same variety containing fat particles are found also in the connective tissue framework of the ridges between the fat-cells. With regard to the epithelial cells during fat absorption, we find that they can be clearly shown to possess during the process large numbers of fat particles all of about one size and fairly equally distributed throughout the cytoplasm. It would seem as though the fat-particles after traversing the epithelial cells were passed on in the first instance to the subjacent connective tissue fat cells and there stored up until their removal is effected by leucocytes. Only the hyaline variety of leucocyte was observed in the intercellular spaces of the epithelium. With regard to these appearances of fat absorption, it is of great interest and importance to find that they occur in both sea and river salmon, including those whose genital products are almost mature. For example, in the case of a female salmon captured in the River Don on November 11th, 1897, in whose ova the yolk spherules had already partially fused, we found that a very extensive fatty deposit existed in the sub-epithelial tissue.

The Condition of the Gut in Kelts.

In kelts practically the same condition of matters exists as those in the spawning salmon. From the fact that undigested food remains have more frequently been found in their stomachs they seem to be more voracious, and their digestive functions become somewhat more active.

The above are the most important points with regard to the walls of the gut of the salmon to which I would at present refer. From such results it may safely be concluded that river salmon though they are not in a condition to feed voraciously as in the sea, still do feed occasionally, much depending on climatic conditions such as the temperature, density, and volume of water. The following facts summarised from the above point to this:

1) The presence of minute microscopic foreign particles in the intestine. These are the indigestible remains of ingested food material.

2) The occasional acidity of the stomachic mucous membrane.

[Both in sea and river fish it should be pointed out that the stomach when not digesting gives either a neutral or a slightly alkaline reaction due to the presence of mucin.]

3) The absence of any catarrhal conditions of the lining membrane of the gut, as affirmed by Dr. Gulland.

4) The activity of the epithelial cells.

5) The presence of leucin crystals in abundance and of tyrosin in the intestine, pointing to the decomposition of proteid through the agency of the pancreatic juice. The accumulation of leucin and other materials is due to the diminished fluidity of the bile and intestinal juices, and to the lessened activity of the gut in general.

6) The presence of crystals of carbonate lime in the intestine, resulting from the ingestion of food materials containing limy structures.

7) The absorption of fat at all seasons and at different stages in the development of the genital organs.

8) The strongly active digestive character of the pyloric and intestinal contents rapidly producing as they do post-mortem digestion.

University of Aberdeen, August 31st 1898.

2. Neue Hydrachnidenformen aus dem sächsischen Erzgebirge.

Von Richard Piersig.

(Vorläufige Mittheilung.)

eingeg. 17. September 1898.

Im Laufe dieses Monats gelang es mir, einige neue Hydrachnidenarten aufzufinden, deren nächste Verwandte bis jetzt nur im Hochgebirge oder im Norden Europas beobachtet wurden. Außerdem erbeutete ich eine characteristisch ausgestattete *Atractides*-Species, sowie einen neuen Vertreter der Gattung *Oxus* Kramer. Von *Aturus scaber* Kramer kam die Nymphe in meinen Besitz.

1) *Atractides gibberipalpis* n. sp.

♂. Körperumriß breitoval, ohne auffällige Einbuchtungen. Integument weichhäutig, liniiert. Maxillarorgan wie bei *Atractides spinipes* Koch. Maxillartaster etwas schwächer als die Grundglieder des ersten Beinpaares, mehr als ein Drittel so lang wie der Rumpf (0,24 mm). Länge der Glieder, in ihrer Reihenfolge von hinten nach vorn gemessen, auf der Streckseite: 0,012 mm, 0,08 mm, 0,088 mm, 0,1 mm und 0,76 mm. 2. Glied am distalen Beugeseiteende mit einem doppelkuppigen, fast quergestellten, an den Spitzen abgerundeten, niedrigen Höcker. 3. Glied ebenfalls auf der Mitte der Beugeseite mit einem stumpfgerundeten chitinösen Zapfen. Haare auf der Unterseite des vorletzten Gliedes ungemein lang, hinter einander gestellt; Seitenrandborste wie bei der Vergleichsart kräftig entwickelt. Endglied in drei feine Zähnchen auslaufend, von denen die beiden unteren hart auf einander liegen. Borsten auf der Streckseite des 2. und 3. Gliedes kräftig, säbelartig gebogen. Epimeren ähnlich wie bei *Atractides spinipes*. Beine mittellang, vom 1.—4. Paar 0,72 mm, 0,592 mm, 0,704 mm und 0,996 mm messend. Vorletztes Glied am 1. Fuß 0,224 mm lang, nach dem distalen Ende zu an Dicke zunehmend, im letzten Viertel wieder sich verjüngend, an der stärksten Stelle (0,068 mm) neben einigen feinen Härchen mit zwei 0,104 mm und 0,092 mm langen dolchartigen Borsten, die im basalen Viertel nach der Einlenkungsstelle schwächer werden. Endglied merkbar nach unten gebogen, am abgerundeten freien Ende mit mäßig großer,