

ART. VII.—NOTES ON THE BONES OF SALMO SALAR SPECIMEN FROM LABRADOR. BY R. MORROW.

Read April 19th and May 10th, 1880.

Spinous Rays, &c. BEGINNING at the junction of the dorsal ridge with the occiput there is a bony process in advance of the first spinous ray; flattened vertically, somewhat broader above, but stouter below, it is attached to the dorsal region by stout fibrous tissue, its ventral extremity at about midway to the 1st spinous ray, and it is the first interspinous bone;* it is entirely different in form, from its representative in the ubiquitous perch, and were it cut out and looked at merely as a fish bone, few would recognize it as an interspinous bone, from the description of such bones as usually given.

2 & 3. The 2nd & 3rd spinous rays have each a short interspinous bone attached to their extremities, overlapping posteriorly.

4. This ray is without the intersp. bone.†

5. The 5th spinous ray has its interspinous bone overlapping in front, and rather longer than those belonging to 2 & 3.

6—15. All these sp. rays have their intersp. bones overlapping anteriorly, but the 15th spinous ray curves posteriorly rather more than Nos. 12, 13 & 14, and at the 15th sp. ray there is an extra interspinous bone $\frac{2}{14}$ (making 2 bones, $\frac{1}{14} \frac{2}{14}$) which does not reach, but its end is opposite the front of the 15th spinous ray, distant about one-quarter of an inch from it; it does not rise so high in the dorsal region as the other interspinous bones, say $\frac{1}{4}$ of an inch less than $\frac{1}{4}$ ($\frac{2}{14}$ lies immediately behind $\frac{1}{14}$, from which it is distant about $\frac{1}{8}$ an inch); $\frac{1}{14}$ and the preceding intersp. bones are nearly equidistant from each other; $\frac{2}{14}$ is very nearly a straight bone, tapering slightly from its dorsal to its ventral extremity. The dorsal ends of the 14 interspinous bones have somewhat broad heads‡ for the attachment of the muscular tissue, and all are curved anteriorly.

16. This spinous ray is without an intersp. bone, but the 4th intersp. fin. bone of the dorsal is slightly in front of it.

*In younger specimens this 1st intersp. bone has almost always its ventral extremity lying between the superior extremities of the 1st spinous ray; as this ray becomes more solid, the intersp. bone seems to be pushed out.

†In a fish from Cape Breton the 4th has an interspinous bone, but the 5th is without.

‡More perceptible in smaller specimens.

16 & 17. Between the points of these spinous rays* is the 5th intersp. fin bone, and at the 17th begins the shortening or hollow in the sp. rays for the insertion of the dorsal fin.

17 & 18. Between 17 and 18 is the 6th intersp. fin bone.

19. Opposite the point of 19, perhaps slightly in front, is the 7th intersp. fin bone.

19 & 20. Between 19 and 20 is the 8th intersp. fin bone.

21. Nearly opposite the point of 21, slightly in advance of it, is the 9th intersp. fin bone.

22. Nearly opposite the point of 22, perhaps a little anterior, is the 10th intersp. fin bone.

22 & 23. Between these, slightly in front of 23, is the 11th.

23 & 24. Between these, slightly in front of 24, is the 12th.

24. Opposite 24 is the 13th intersp. fin bone.

24 & 25. Between these, slightly in front of 25, is the 14th.

26.† Slightly in front of 26 is the 15th intersp. fin bone; at the posterior junction of these intersp. fin bones with the fin rays, and attached to the prolongation of the 15th intersp. fin bone from its lower extremity, the fibrous tissue descending and attached to 26, 27, 28, 29, 30—the 26th, 27th, 28, 29th and 30th spinous rays is rather stronger than that which is attached to the other sp. rays. The height of the intersp. column from the centre of the vertebræ; at right angles to the junction of the fin rays, is at the anterior face of the dorsal fin $3\frac{1}{2}$ inches; at the posterior face, $3\frac{1}{4}$ inches; length of dorsal from anterior to posterior edge is $3\frac{3}{4}$ inches, and, including the prolongation of the 15th intersp. fin bone, $4\frac{1}{4}$ inches.

29-42. From, and including 29 to 42, the superior caudal spinous rays are wider at their dorsal ends than are the other dorsal sp. rays; from 26 to 42, the height of the dorsal sp. rays is nearly 42-53. equal, and from 42 to 53 they rapidly decrease in length, and their dorsal ends are comparatively narrow.

54-55. At the point of this sp. ray begins the upper or dorsal portion of the caudal fin (the ventral portion begins also at the 54th). The 54th and 55th sp. rays are anchylosed at their

* The shortening of the spinous rays for the insertion of the dorsal I do not find in some specimens of the Cape Breton Salmon.

† The hollow for the dorsal is here completed and the spinous rays begin to rise.

bases, and towards the anterior dorsal edge of 55 the bony plate nearly touches 54.

55, 56, 57. Are anchylosed, and on 57 is the last dorsal spinous ray proper; but in addition, and anchylosed with the three spinous rays above named, are two or three other rays, which may be termed representative. I cannot decide their number they are so confused. These three rays unite with a short bone, which is attached to the 57th sp. ray, and lies nearly parallel with the 57th and 58th spinous centra. The 57th spinous centrum begins to rise, that is, to curve upwards towards the dorsal edge of the caudal fin, and with the 58th and 59th centra and the lower Y shaped bone between the forks of which the notochord passes, forms an angle with the anterior part of the spinal column of about 35 degrees.

Saddle bones. Beginning at the posterior edge of the 56th centrum are a pair of bones of irregular and peculiar shape, one on each side of the spine. They are attached to the dorsal edge of the spine, and are joined by strong cartilage in this specimen, by their ventral anterior edges to the posterior edge of the 56th centrum, covering the ventral end of the 57th. sp. ray, anteriorly about $\frac{1}{8}$ of an inch, nearly at the middle of its height; their dorsal edges pass over the 57th sp. ray, posteriorly they cover and attach the three rays which do not reach the spinous centra, 58 and 59. These bones, which, for lack of a better name, I will call *saddle* bones, attach the three rays which I have already spoken of as representative rays, by cartilaginous union to the spinal column. When these bones are in their proper position the spinous rays appear to be all perfect; but the 58th and 59th centra have no dorsal spinous rays. Close to the posterior end of these saddle bones, protecting the notochord, and lying under the anterior edge of the short caudal fin ray, No. 10, reaching nearly to the dorsal edge of the spinous centra, is on each side a short irregularly shaped bone, about $\frac{5}{8}$ of an inch in length, somewhat pointed at either end. On the outer sides of the posterior extremities of these two short bones, the points of the short caudal rays next to the first perfect dorsal caudal fin-rays, right and left side, have a slight attachment.

The next bone we meet has its anterior edge divided, that is, it is Y shaped, so as to admit between its points the passage of the notochord, together with its protecting tissues, and the posterior edges of the saddle bones nearly touch the points of this bone. Its posterior or outer edge is united, but in a younger specimen would probably be found as two separate bones. This bone is of the same shape, but about half the size of the Y shaped bone to be noticed in the ventral aspect of the spinal column.

I have thus reached the dorsal extremity of the spinal column, not including the spongy centrum to which the fourth or upper hypural bone is attached, and which makes, if included, 60 vertebræ.

Spinal Column, Ventral aspect—Ribs.

C. 1 & 2. There are no ribs on the 1st and 2nd centra, these being so situate as not to require them, but there are their representatives in the shape of processes.

1st pair on 3rd. From the 3rd centrum, at its lower edge spring the first pair of ribs, which are somewhat crooked in shape, and naturally shorter than the others. They are comparatively round bones, and in length from articulation to point 2 inches.

C. 4. The second pair of ribs, measured in a direct line, that is, not following their curve, are $2\frac{3}{4}$ inches in length and slightly deeper measured transversely than they are laterally, and taper to a point.

C. 5. The third pair are $3\frac{1}{4}$ inches long.

C. 6. The fourth pair are $3\frac{3}{4}$ inches long.

It is not necessary to give the lengths of the remainder of the ribs, but it may be remarked that I find in the salmon, that the first two pair of ribs may be termed short, and that from and including the 3rd pair, to and including the 13th pair, they are of much greater transverse than longitudinal diameter, decreasing in the length of the transverse breadth as they succeed each other posteriorly—7 to 12 are the longest and broadest ribs. The remaining ribs are widest at their attachment and gradually decrease in size towards their points.

C. 27. At the 25th pair of ribs on the 27th centrum are a pair of

very short spinous processes lying in front of their articulation with their centrum.

C. 28. The 26th pair of ribs have spinous processes about $\frac{1}{8}$ of an inch in length, to which they are attached and pass posteriorly to their articulation.

C. 29. The 27th pair are united by cartilage to the end of, and behind spinous processes $\frac{1}{2}$ an inch in length on the 29th centrum, their ends do not reach the centrum but are attached posteriorly to the sp. processes. This pair are not so flat as their preceding ribs.

C. 30. The 28th pair. The spinous processes to which this pair are attached are $\frac{5}{8}$ of an inch in length, and their attachment rather more than a quarter of an inch.

C. 31. The 29th pair are attached posteriorly to strong sp. processes $\frac{5}{8}$ of an inch in length, which are united transversely forming the first hæmal arch.

C. 32. The 30th pair. Their spinous processes are also about $\frac{5}{8}$ of an inch in length to which the attachment of the ribs is about $\frac{3}{16}$ of an inch.

C. 33. 31st pair of ribs } have sp. processes $\frac{3}{4}$ and $\frac{15}{16}$ of an inch

C. 34. 32nd do. } in length, and have short attachments to their processes.

C. 35. On this centrum, (the last of the abdominal centra), attached to spinous processes, which are united at their ventral ends, are the 33rd and last pair of ribs. A hasty examination of this specimen might lead one to say that it has only 32 pairs of ribs; but the dorsal ends of the 33rd pair are attached closely together and to the narrow point of their sp. processes, and are anchylosed. The examination of younger fish makes this certain. This pair of united ribs forms the support of the anterior interspinous fin bone of the anal fin, which in this case it overlapped, and was attached on the right hand side about $\frac{3}{8}$ of an inch.*

The ventral ends of the last five or six pairs of ribs gradually approach each other until they touch in the last or 33rd pair,

* The sp. processes of the 29th, to and including the 33rd and last pair of ribs, are transversely united, making five abdominal hæmal arches.

producing the beautiful outline of the posterior part of the salmon.

C. 36. On this centrum, (the first of the caudal centra proper), the spinous processes are $1\frac{1}{2}$ inches in length, and attached posteriorly for $\frac{3}{16}$ of an inch is a bone or bones having an extreme divergence from the normal angle, which might be taken for a pair of ribs. The sp. processes, of which mention has been made, are all of the same character as the dorsal and other spinous rays, that is formed of two bones, one springing from each side of the arch and united more or less strongly, as the age of the fish may be. This bone, or if you choose pair of bones are anchylosed and appear as one, their length from the junction with the sp. processes is $2\frac{3}{16}$ of an inch; in the skeleton before you the separation of their ventral ends is a consequence of their dryness. An examination of younger fish will show you that this bone (or bones) originates in a different way from the ribs; looking at this skeleton of what may be called a mature fish, it appears to be a single bone and to have originated and grown from the end of the spinous process, passing and uniting with its next posterior ventral spinous ray having its ventral end attached to the end of the 3rd interspinous fin bone of the anal fin which it slightly overlaps, say $\frac{1}{4}$ inch on the outer or right hand side. In a young fish you will find the spinous processes, but the long bone is merely a short straight bone lying between the processes on the 36th and 37th centra; in the skeleton of the young-fish before you the bone does not touch the posterior edge of the 36th sp. process, but is about $\frac{1}{16}$ of one inch from it and it just touches the anterior edge of the spinous process of the 37th centrum, the end of which it does not reach by nearly half an inch; it is therefore most probable that it grows from a centre each way, that is dorsally and ventrally, but that its growth is most rapid towards its ventral extremity.

C. 37. On this centrum (counting the ribs as sp. processes) the 35th ventral sp. ray is attached, and is the first ventral sp. ray having the usual form; it is $1\frac{1}{4}$ inches in length, its ventral anterior extremity is united by cartilage to the bone just mentioned as springing from the end of the 34th sp. process, the great

divergence of which will be perhaps better understood by mentioning that while it lies at an angle of about 14° with the spinal column, the ventral sp. ray springing from this centrum forms its angle about 65° .

C. 38. The spinous ray No. 36 is about $1\frac{3}{4}$ inches long (being a sudden increase of length) and is free—that is, only attached by tissue to the interspinous fin bones of the anal fin. It and the succeeding four spinous rays have wide ventral ends for similar attachment, and are of about equal length.

C. 39. The end of the 37th sp. ray has opposite its point the 4th intersp. bone of the anal fin.

C. 40. The 38th sp. ray has opposite its anterior edge, the 5th intersp. anal fin bone, and opposite its point, the 6th intersp. fin bone.

C. 41. Slightly in front of the 39th sp. ray is the 7th intersp. fin bone, and the 8th is opposite its point.

C. 42. The 40th sp. ray has opposite its centre, the 9th intersp. fin bone; and the dorsal extremity of the 10th and last intersp.

C. 43 fin bone of the anal lies exactly between this and the 41st sp. ray, which is about the same length as the five preceding rays, but its ventral end is somewhat narrower.

C. 44. The 42 sp. ray. } The ventral extremities of these 4 spinous rays are about the same breadth
45. " 43 " } as the 41st, but the tissue attaching to
46. " 44 " } them, the posterior edge of the 10th intersp. fin bone of the anal, which curves posteriorly, (its ventral end being opposite at right angles to the end of the 44th spinous ray, in order to afford sufficient support), is stronger than that in some other parts of the fish. The total depth of the skeleton at the anterior edge of the anal fin to the edge of the dorsal sp. rays is 5 inches, and at its posterior edge $3\frac{1}{2}$ inches.

C. 48. The 46 sp. ray. } These sp. rays are regular in shape, but
49. " 47 " } their ventral ends are not expanded,
50. " 48 " } they show a gradual decrease in length,
51. " 49 " } which begins from the 41st sp. ray, the
52. " 50 " } 50th ray being $1\frac{1}{2}$ inches long.

C. 53 51. This ray is stronger than those immediately pre-

ceeding it. Its breadth is about equal throughout. It has a somewhat blunt ventral end, and it is $1\frac{1}{4}$ inches long; in the slight hollow between this and the 49th sp. ray, is attached the beginning of the caudal muscle which envelopes the short rays of the caudal fin.

C. 54. Opposite the end of the 52 sp. ray begin the short ventral rays of the caudal fin at right angles to the posterior edge of the 56th centrum. The character of the attachment of the ventral sp. rays appears to change with this centrum, their dorsal ends have spread and are in one sense flattened and seem to have an articulated surface as may be noticed by looking at the 52nd, 53rd, 54th, 55th and 56th ventral sp. rays on this skeleton. The posterior edge of this ray (52) is anchylosed with the anterior edge of 53 for about two-thirds of their length from their dorsal towards their ventral extremities.

C. 55. The 53 sp. ray. } these bones are more or less perfectly
 56. " 54 " } anchylosed, their shapes are so irregular
 57. " 55 " } that only a drawing (which I regret to
 say I am unable to make) or reference to the skeleton can give you a clear understanding of them.

58—56th sp. ray. This ray is anchylosed on its anterior edge to the 55th sp. ray for about half its length, say $\frac{5}{8}$ of an inch, and on its posterior edge rather more than half its length, say half an inch from its foramina* towards its ventral extremity, to the lower hypural bone; on its ventral end it is free, say $\frac{7}{16}$ of an inch. In shape this ray differs from all the others, at its dorsal end it is somewhat triangular, having a cup-like projection on each side at its junction with its centrum, and its ventral end is included in a cartilaginous rim which passes round the bones forming the termination of the column. This bone, together with the two saddle bones on the dorsal aspect of the spine, appear to me to be the representatives of the pelvic bones in mammals.

* The foramina in this bone are for the passage of the blood vessels. The superior in this specimen passes to the left, the inferior to the right side, each opening into a sack or sinus having a communicating foramen which lies between the first lower and second lower hypural bones. There is also a foramen at the junction of this bone with the anterior edge of the lower hypural in this specimen, of considerable size, in others smaller in proportion.

59-¹_H. To this vertebral centrum is attached the lower hypural bone, which has a somewhat narrow neck, caused by a foramen on its anterior edge, which passes between it and the ray on the 58th centrum, and a double foramen passing between the posterior edge of this hypural bone and the anterior edge of the second; this double foramen appears to be for the passage of vessels uniting the (pulsating?) sacks. Also attached to this centrum is the second hypural bone; it is notched on its ventral anterior surface by the foramen above mentioned, the division of which is nearly parallel with the centrum; this division is caused by a slight projection in the centre of the foramen on this, as well as on the bone already described. At the posterior extremities the adjacent faces of the above two bones are partially rounded, that is, their adjoining corners are rounded off, and in the hollow thus formed, which is slightly above a line drawn through the centre of the spinal column, is a nervous corpuscle, so shrunken in this skeleton as now to be scarcely observed, but when fresh, it measured three sixteenths of an inch in diameter. This corpuscle projects slightly beyond the edge of the hypural bones.

60. Attached to the ventral surface of a spongy centrum is the third hypural bone, and to its end, if indeed it does not belong to it, is attached the fourth hypural bone, terminating the sixty centra of the spinal column. We have therefore four hypural bones, which being strongly connected together as well as to the posterior ventral rays, form a broad solid plate for the attachment of the muscles, and the strengthening of the rays of the caudal fin. The bone lying next above this is the larger Y shaped bone, the notochord passes between the forks of this bone as in the smaller bone of similar shape.

Prof. Huxley's drawing, representing the tail of the *Salmo* published in his "Manual of the Anatomy of Vertebrated Animals," page 20, is incorrect if the *Salmo* of England are the same as ours. He makes the vertebral column in this drawing to end in a line common to the anterior vertebræ, and at the end of the last centrum which is drawn of greater diameter than those which precede it, is attached at an angle nearly equal to that formed by the posterior part of the spinal column in the skeleton before you, a terminating bony plate,

and to the ventral edge of this are attached *two* hypural bones. There are also some other bones which do not correspond to some in our *salmo*. On page 131 of the same work he says, "the spinal column appearing to terminate in the centre of a wedge-shaped hypural bone, to the free edges of which the caudal fin rays are attached, so as to form an upper and a lower lobe, which are equal or sub-equal. This characteristically Teleostean structure of the tail-fin has been termed homocercal—a name which may be retained, though it originated in a misconception of the relation of this structure to the heterocercal condition."

The caudal fin-rays in my specimen are not attached to the "free edges of the hypural bones," but their divided ends overlap the hypural bones on each side; on the dorsal part about five-eighths of an inch; a quarter of an inch on the central, and from a quarter to half an inch on the inferior or ventral part. In the drawing referred to one of the fin-rays is inserted in a notch in the posterior edge of the upper hypural bone, nearly in the place where the corpuscle already mentioned should be.

Transverse Processes.

The transverse processes are attached directly to the centra, and begin on the 1st centrum. The first four are nearly at right angles to the column, and project posteriorly into the fleshy tissue, and are say $\frac{1}{4}$, $\frac{2}{2}$, $\frac{3}{1}$, $\frac{4}{1}$ inches in length, from 4 to 25, their outer extremities rising gradually towards the dorsal line. They are of variable length, 1 to $1\frac{1}{2}$ inches, not gradually decreasing, but some long, others shorter—including 26 to 32, they rise rapidly towards the dorsal line, so that their dorsal ends are near to the spinous rays; all the transverse processes arise from their centra posterior to their corresponding ray. Besides the transverse processes enumerated, which are bony, there are some that appear to be attached by tissue to their centra, having soft bony extremities: these have their attachment gradually rising on the dorsal spinous rays, but soon they lose their bony texture, and appear only as threads attached to the muscular tissue.

Dorsal Fin.

The dorsal spinous rays make an angle with the spinal column (speaking generally) of from 35 to 42 degrees, and the first interspinous fin-bone of the dorsal fin consists of three bones anchylosed, appearing at the articulation of the dorsal fin ray as one bone expanding into three. The anterior edge of these bones has a somewhat broad face, three-sixteenths of an inch at its widest part, and it is seven-eighths of an inch in length; from the dorsal end of $\frac{1}{4}$ interspinous bone, springs a very strong fibrous attachment, embracing the inserted ends of the triple intersp. fin bone; it then passes downward and is strongly attached to the end of the 4th intersp. fin bone, (counting the short bones above mentioned, as three), which is the first long intersp. fin bone of the dorsal fin. This bone is slightly in front of the 16th spinous ray, which has no extra interspinous bone. The 16th sp. ray is a little less in length than 15, and from it, to and including the 25th ray, a gradual curve is formed by the extremities of the dorsal spinous rays for the insertion of the dorsal fin and its appendages.*

1st intersp. fin bone,	$\frac{7}{8}$	in length.	} these 3 bones anchylosed.
2 " " "	1	"	
3 " " "	$1\frac{3}{8}$	"	

4 intersp. fin bones, is $2\frac{11}{16}$ inches in length, and forms an angle of 42 degrees with the vertebral column, while the sp. ray (16) to which it is opposite makes an angle of 35 degrees.

5 intersp. fin bone $2\frac{5}{8}$ inches lies between the points of 16 & 17 sp. rays, angle 40 degrees.

6 intersp. fin bone $2\frac{1}{2}$ between 17 & 18, angle 43 degrees.

7 " " " $2\frac{1}{8}$ slightly in front of 19, angle 54 degrees.

8 " " " 2 between 19 & 20, angle 55 degrees.

9 " " " $1\frac{7}{8}$ slightly in advance of 21, angle 55 degrees.

10 " " " $1\frac{3}{4}$ slightly in front, of 22, angle 55 degrees.

11 " " " $1\frac{3}{4}$ between 22 & 23, angle 56 degrees.

12 " " " $1\frac{5}{8}$ slightly in front of 24, angle 55 degrees.

13 " " " $1\frac{5}{8}$ opposite the point of 24, angle 52 degrees.

14 " " " $1\frac{5}{8}$ slightly in front of 25, angle 51 degrees.

*This is much more apparent in the skeleton of the young Salmon.

15 and last intersp. fin bone is $1\frac{1}{2}$ inches in length. It has a prolongation posteriorly for the attachment of the last single together with the double fin ray, and also for the strong fibrous attachment which connects it with the dorsal muscle.

The fin-rays of the dorsal fin are in number 15. By some they would be counted as 14, but further on I will give the reason for counting them as 15.

1st Ray. This ray is so small as to be easily overlooked in young specimens. In this one from its root or articulation with its intersp. bone it is five-sixteenths of an inch in length: the point of it reaches only through the skin, but it is a true ray, having its bony regular articulation just above the anterior face of the short one of the triple bone.

2nd ray. The second ray is five-eighths of an inch, and

3rd ray. the third ray is one and three-eighth inches in length, these first three rays are covered or as it were included in the integument as one ray.

4. The fourth, or first ray having its full length, is three and seven-eighth inches from articulation to point; divided at its ventral extremity to form its articulation on each side of the interspinous bone, as are all the fin-rays.

5 to 10. are all of the same type gradually decreasing in length to ten, which measures two and three-eighth inches.

11. The eleventh ray is two and one-eighth inches.

12. The twelfth ray is one and seven-eighth inches.

13. The thirteenth ray is one and five-eighth inches.

14 & 15. Although apparently so closely united, 14 & 15 are separate fin-rays, having each an articulation, that is, the 15th ray is set within the 14th. They are attached as before stated to the posterior extremity of the 15th intersp. fin bone, and if the first three short rays are to be counted, then should these rays be counted as two, for though they are articulated to one base, yet each is a complete ray.

The height of the interspinous bones of the dorsal fin, to the junction of its fin-rays, from the centre of the vertebræ at right angles to the anterior edge of the fin, is three and a half inches; at the posterior edge, three and a quarter inches; length of dorsal

fin from anterior to posterior edge, (rays only) three and three quarter inches, and including the end of the last interspinous bone four and a quarter inches.

Adipose Fin.

Of the adipose fin there is little to say. Its anterior edge is opposite the posterior edge of the base of the anal fin, it has no attachment through the dorsal muscle to the general muscular tissue. It appears to be an expansion of the integument, and has its base in the cord of the dorsal muscle, which is somewhat thickened and of firmer structure, (more like a cord), where it appears, more so anteriorly than posteriorly. There does not appear to be in it anything which can be called a fin-ray. I have examined a number of *S. salar* as well as *S. canadensis*, with a good glass without discovering any trace of what might be termed a ray, but I cannot say that the microscope would not bring them to view. The only difference observed by me is that while most are smooth and rounded off at the dorsal edge, some present a few of what might be termed raylets, forming a delicate feathered edge.

Caudal Fins.

At the point of the 54th spinous ray begins the upper or dorsal portion of the muscle of the tail rays: this beginning of the caudal fin, which is enveloped by the muscle consists of eleven short rays or spines, filling in and giving to the tail as a whole its line of beauty, strengthened by the anchylosed dorsal sp. rays, and adding to the propelling power of the tail. These short rays are all divided at their anterior ends (or V shaped) united on each side to the general structure, presenting at the dorsal edges the appearance of single rays.

1-4. 1-4 are short and straight.

5-6. 5-6 are somewhat curved, the 6th more pointed at its outer extremity than the 5th.

7. 7 is single at its insertion and divided into two rays at its extremity, and from its division to outer end somewhat curved and pointed.

8 & 9. The 8th & 9th are single at their insertion as well as at their dorsal ends. 9 is one and a half inches long.

10. The 10th short ray is nearly straight. Between ten and eleven, attached to the upper edge of the 11th short fin-ray, at about $1\frac{1}{2}$ inches from its inferior end is an extra bone $\frac{9}{16}$ of an inch in length.

11. This ray is nearly straight, curving at its outer end to follow the shape of the long rays; it has a very thin pointed ventral end; its length is two and a half inches.

The first short fin-ray is about $\frac{5}{16}$ of an inch long.

The eleventh short fin-ray is about two and a half inches long.

The caudal fin has nineteen long or perfect rays, (their insertion in this specimen will average about one inch in length,) which begin to divide or split up into a great number of fin rays, shortly after the exit of the tail from its root or body of the fish. The first and second rays counting from the dorsal region are exactly opposite to the centre of the elevation of the spinal column, so that there are seventeen whole rays beneath it.

1 to 8. The first eight rays are closely united by strong fatty tissue to their emergence from the integument.

8 to 9. Between the inferior ends of eight and nine there is a space of irregular outline filled with fatty tissue which extends some distance between these rays, at its widest part it measures $\frac{3}{16}$ of an inch.

9 & 10. The inferior extremities of these rays meet for $\frac{3}{8}$ of an inch and are then separated for about $\frac{5}{8}$ of an inch.*

10 & 11. Are separated at their emergent ends.

11 & 12. do. do. do.

The 9th, 10th, 11th & 12th rays are broader on their inserted ends by cartilaginous matter, than are the other rays.

12 & 13. The inserted ends of 12 and 13 join for about a quarter of an inch, but are then widely separate, and the ray thirteen is inserted into the root of the tail an eighth of an inch more than twelve.

All the spaces enumerated above, beginning between eight and nine and continuing to that between twelve and thirteen extend into the tail proper as a sort of web by which the tail may be expanded and contracted in its width.

* 10th ray.—A line drawn through the centre of the spinal column touches this ray, the centre ray of the caudal fin.

13 & 14. Are close together to the beginning of the tail proper.
14 & 15. Are close at their inserted ends, slowly separating until divided for the expanse of the tail, when they appear as close together.

15 & 16. Almost unite for one inch, they then appear as slightly separate.

16 & 17. Inserted ends close, then very slight separation.

17 & 18. Same as above.

18 & 19. Close together, nineteen being the ventral ray. The first three outer rays of both aspects of the caudal fin, dorsal and ventral are very strong.

The short rays of the caudal fin on the ventral side beginning at the end of the fifty-fourth spinous ray, are eleven in number

<p><i>1st.</i> This short ray which is next the nineteenth caudal ray proper, is $2\frac{1}{2}$ inches long.</p> <p><i>2nd.</i> The second short ray is 2 inches long.</p>	}	<p>these two are nearly straight and pointed at either end.</p>
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3rd. The third short ray is $1\frac{3}{4}$ inches long; pointed and slightly curved laterally.

4th. The fourth short ray is $1\frac{1}{8}$ inches long; more curved laterally than the third.

5th. The fifth short ray is 1 inch long; slightly curved.

6th to 11th. These are all curved more or less, and the eleventh is a quarter of an inch long. The points of these short rays are united as the spinous rays, and enveloped as the dorsal short fin-rays by the tail muscle; they have a little more separation than the dorsal short fin-rays, and are deeper than their breadth.

Anal fin.

The anal fin begins, or rather the anterior end of the first intersp. fin bone is attached, as before stated, to the end of the 33rd pair of ribs (on the 35 centrum). This intersp. bone is $2\frac{5}{8}$ inches long, and has upon its ventral anterior surface a heart-shaped shield, half an inch wide at its dorsal edge, and in depth $\frac{3}{8}$ of an inch, which is attached by cartilage to the intersp. fin bone. On the lower face of this shield or plate is a short cartilaginous ray, (half an inch long) having a bony base. It has no articulation

but cartilaginous matter between it and its suspending plate. This soft ray is so closely covered with fatty tissue as scarcely to be noticed unless by dissection.

1st ray. Directly in a line with the first intersp. fin bone is the first short fin-ray, which (as do all the remaining fin-rays) divides at a short distance from its articulation with the intersp. fin bone, one half passing to each side of it, the foot shaped joint pointing posteriorly being comparatively shorter than the others. The length of this ray is $1\frac{1}{8}$ inches, and its anterior face is attached by tough fatty tissue to the rudimentary ray first described.

2nd. The second short fin-ray is directly opposite, and attached to the end of the second intersp. fin bone, shaped like the first. It is $1\frac{3}{4}$ inches long.

3rd. The third or first perfect fin-ray is attached to the anterior edge of the third intersp. fin bone, and this in its turn is attached to the end of the peculiar spine, which springs from the thirty-sixth centrum, and to which as before noticed the end of the thirty-fifth ventral sp. ray is united. And here it would seem that as this is the first perfect or full length fin-ray of the Anal, some provision was required to add to its strength, which is attained by the junction of the thirty-fifth spinous ray with this long slight bone. The thirty-sixth sp. ray being directly between the third and fourth intersp. bones, leaves a space rather more than one-fourth of an inch in width and thereby changes the angle of the remaining intersp. fin bones. Thus the general angle formed by the first intersp. fin bone with the spinal column, which intersp. fin bone is attached to the thirty-third pair of ribs, is thirty degrees, while that formed by the fourth intersp. bone is thirty-seven degrees.

4th. The fourth fin-ray is attached to the centre of the fourth intersp. fin bone.

<i>5th.</i>	Same attachment to five.	} intersp. fin bones.
<i>6th.</i>	“ “ “ six.	
<i>7th.</i>	“ “ “ seven.	

The 3rd, 4th, 5th, 6th and 7th fin-rays are thicker than the others.

8th. The eighth fin-ray is not so strong as its anterior five rays,

and is attached to the eighth intersp. fin bone. As the length of the rays of the anal decrease so does their strength, but much more in proportion in this and the remainder of the rays.

9th. The ninth fin ray is on the 9th intersp. fin bone, which is slighter in proportion than the 8th or 10th intersp. fin bones. The tenth intersp. fin bone, the end of which lies between the 41st and 42nd spinous rays, with its posterior ventral extremity opposite at right angles to the end of the 44 sp. ray, is, as will be noticed by you, differently shaped from all the other intersp. fin bones of this fin, (somewhat resembling the posterior intersp. fin bone of the dorsal fin) having a strong posterior curve at its ventral extremity, and an increase in breadth, presenting a broad face (or end) for the articulation of three fin rays, counting, as on the dorsal fin and for the same reason, the last rays as two. Its extreme posterior edge is furnished with the usual attachment for the muscular tissue which supports the posterior edge of the fin.

10th. The tenth fin-ray is attached to the anterior edge of the tenth intersp. fin bone, which as just noticed has a slight projection for its articulation.

11th & 12th. These two fin-rays lie closely together, but as they have a double articulation, (as the two on the dorsal fin,) they clearly must be called two distinct rays. They are also (as in the dorsal) articulated one within the other, and attached to a slight depression closely in front of the posterior edge of the tenth interspinous fin bone.

Mem.—1 intersp. fin bone $2\frac{5}{8}$ inches long.

2	"	"	"	$2\frac{5}{8}$	"	"
3	"	"	"	$2\frac{1}{2}$	"	"
4	"	"	"	$2\frac{1}{8}$	"	"
5	"	"	"	$2\frac{1}{16}$	"	"
6	"	"	"	2	"	"
7	"	"	"	$1\frac{7}{8}$	"	"
8	"	"	"	$1\frac{3}{4}$	"	"
9	"	"	"	$1\frac{5}{8}$	"	"
10	"	"	"	$1\frac{3}{4}$	inches long to depression for attachment of the eleventh and twelfth fin rays.	

2-5. The 1st, 2nd, 3rd, 4th and 5th fin-rays are slightly separated from each other.

5 & 6. Between 5 and 6 there is nearly $\frac{1}{8}$ inch of space.

6 & 7. Between 6 and 7 a little more, say $\frac{1}{8}$ inch of space.

7 & 8. Between 7 and 8 a little more than $\frac{1}{8}$ inch of space.

8 & 9. Between 8 and 9 a full $\frac{1}{4}$ of an inch of space, just below their articulation.

9 & 10. Between 9 and 10 not quite $\frac{1}{4}$ of an inch of space.

10 & 11. Between 10 and 11 just perceptibly more than between nine and ten.

11 & 12. touch but are not united, and are therefore separate rays.

Ventral Fins.

These fins are attached to two bones which are imbedded in the strong fatty muscular tissue in the belly of the fish. They appear on its surface opposite at right angles to the 12th dorsal ray, and are attached to the two bones already referred to, commonly called the pelvic bones, which in this specimen are $3\frac{1}{4}$ inches in length, measured from the centre of the left bone to its point or termination of its junction with the bone of the right side to which it is united* by cartilage, forming a somewhat rounded termination. For convenience I will take one, the left of these bones. You will notice at once its peculiar shape, its posterior end has a stout transverse ridge; extending and springing from this laterally on its outer edge is a ridge increasing a little in size until it is about $\frac{1}{8}$ of an inch in thickness, rounded on its dorsal aspect and projecting rather more than $\frac{1}{16}$ of an inch above a thin bony plate $\frac{5}{8}$ of an inch in breadth at its posterior extremity; decreasing anteriorly to a point which is united to the transverse ridge as far as its inner end, and extending along the lateral ridge two inches, this lateral ridge being prolonged anteriorly $\frac{3}{4}$ of an inch beyond the thin plate or blade. On the ventral aspect the plate or blade rises, following the curve of the lateral ridge which in consequence does not show any abrupt projection. The posterior end of the bone or transverse ridge is, in this specimen, one inch in breadth, and to it the

*In young specimens they can scarcely be said to be united.

fin-rays are attached. The outer head of the transverse ridge projects a little beyond the lateral ridge, the space so formed being filled with cartilaginous matter from which springs ligamentous attachment running some distance along and tying this bone with the muscles of the belly. On the inner edge of the bony blade and attached to the cartilage on its anterior edge, strong fibrous tissue passes enveloping the blade as well as the anterior ends of the lateral ridge, from thence passing to the general muscular tissue. A similar attachment passes posteriorly from the cartilage between the pelvic bones, having attachment to the inner ends of their transverse ridges, with divergent connections to the integument covering the rays immediately under the point where the inner fin-rays appear upon the surface of the fish, from thence continuing some distance as a strong band down the centre of the belly. The pelvic bones are not always parallel with a line drawn through the centre of the belly, but are occasionally somewhat distorted, that is each forming a different angle with such central line.

The ribs from and including No. 15 & 22 are shorter in proportion than the others; this is in order to allow for the insertion of the pelvic bones, thus preserving the line of beauty. The space so afforded by the shortening of these ribs is 4 inches in length; (that is from the end of 14 to 22,) the length of the pelvic bones being $3\frac{1}{4}$ inches, and from them to the extreme posterior end of the long fin-ray is $3\frac{3}{4}$ inches, making a total length of the fins and their attachments $6\frac{5}{8}$ inches average, allowing for the overlapping of the fin-rays upon the pelvic bones. It must however be borne in mind that the fin-rays owing to their curves, are of eccentric lengths, there being a difference in the measurements as they are taken from the dorsal or ventral aspects; in the lengths above I have taken the dorsal aspect in a straight line (not round the curve of the ray), the measurement of the ventral aspect of the same ray is $3\frac{1}{2}$ inches.

The ventral fins each contain 9 rays and each fin has a ventral appendage, in this case they are $1\frac{1}{2}$ inches in length.

1st. The first or outer ray divides at $1\frac{1}{4}$ inches from its attachment to the pelvic bones (that is visibly); on its ventral aspect it is at-

tached to the pelvic bones by fibrous tissue and has a curved termination: on the dorsal aspect it curves strongly, forming a double heel each $\frac{3}{8}$ of an inch in length. The dorsal aspect is strongly attached by fibrous tissue to the outer head of the pelvic bone; and the inner heel is also embraced in similar attachment, together with the flat bony root of the ventral appendage ("axillary scale" of Dr. Gilpin.) from the outer side of which passes a muscle into the general muscular tissue. From the outer heel a strong muscle is attached passing in the same way. It may here be mentioned that there is a strong band of muscular fibre passing forward from the ventral appendage, which, with its other muscular attachments, causes these appendages, when the ventral fins are in motion, to pass under them so as to protect the hollow which appears at the root of the ventral fin, preventing the lodgment of any floating material, such as sawdust or chips in what must be a sensitive part. As soon as the ventral fins are at rest these appendages withdraw themselves and lie parallel with their outer edge.

Dorsal aspect ventral:

1st.	The first ray measured in a straight line from heel to extremity is $3\frac{1}{2}$ inches in length.
2nd.	" second " " " " $3\frac{1}{2}$ " "
3rd.	" third " " " " $3\frac{1}{4}$ " "
4th.	" fourth " " " " 3 " "
5th.	" fifth " " " " $2\frac{3}{4}$ " "
6th.	" sixth " " " " $2\frac{1}{2}$ " "
7th.	" seventh " " " " $2\frac{1}{8}$ " "
8th.)	<i>crowded.</i> " eighth " " " " $2\frac{1}{8}$ " "

The heel of the eighth is not like those of the previously mentioned rays, as its anterior end is very slightly raised towards the dorsal aspect, and slightly curved in opposition to the heels of the other rays; it passes very close to, and almost under the heel of No. 7 and near to the pelvic bone.

9th. The ninth ray has no heel on the dorsal side, but it has a slight upward curve in its line of direction tending towards the other rays, its length is $1\frac{3}{8}$ inches, its anterior extremity passes

also close to the heel of No. 7 giving a crowded appearance to the last three rays, which are attached by strong fibrous tissue to the dorsal side of the inner ventral heel or broad plate of No. 9, which is turned inwards towards the outer side of the fin in opposition to the heels of the other rays, (it being the only ray having this peculiar form); this broad plate is in its turn attached to the stout transverse process of the pelvic bone upon which its ventral surface moves; in addition to this broad plate it has upon the ventral side the usual termination. The rays No. 2, to and including 8 are nearly of the same shape.

Ventral aspect, Ventral fin.

Here the rays, may, at their anterior ends be said all to curve towards the centre of the fish.

1st ray. The curve of the first ray fits upon the ventral aspect of the enlargement or head of the outer edge of the pelvic bone, having very strong ligamentous attachment.

2nd. The second has the same attachment, its curved end terminating on the inner edge of the ventral aspect of the outer head of the pelvic bone.

3-9. The remaining rays have all a similar attachment, their anterior curves becoming less, until No. 9 is almost straight, and the ends of all gradually receding.

The dorsal heel of the 2nd ray is opposite to its ventral extremity, but the other rays gradually recede on the dorsal side until the anterior extremity of the 9th ray ventral aspect is one quarter of an inch in advance of the dorsal side of the same ray.

When the ventral fins are in motion or extended, all the anterior ends of the fin-rays appear closely crowded together, more so on the ventral than upon the dorsal aspect.

You may perhaps remember that in describing to you the dorsal aspect of the spinal column, your attention was drawn to two bones lying above the 57th centrum, covering it together with the 58 and 59th and partially that which may be called the 60th centrum, leaving on the dorsal aspect three centra unprovided with spinous processes; on the ventral aspect your attention was also directed to a conical process different from all the other spinous processes which I said together represent in my view the

pelvic bones. The bony plates to which are attached the ventral fins, together with the fins are usually called the pelvic limbs, but it appears to me there can be little doubt that the so called pelvic bones with the fins are the representatives of the hind legs of mammals, thus :

The saddle bones and the bone with the cup shaped orifices below them, are the pelvic bones.

The centra without spinous processes, the sacral vertebræ.

The large hypural bone, the femur.

The pelvic bones, or the bony plates to which the fins are attached ; the tibia and fibula and the ventral fins generally the feet.

The Shoulder girdle and Pectoral fins.

At the junction of the body with the head under the opercular plate, appears on each side of the fish a series of bones forming the fore frame and support of its body, and from which spring at about two-thirds of their total length the pectoral fins. In the specimen of the salmon before you on their outer sides each set appears primarily to be formed of three bones. Reversing these bones and looking at their inner surfaces there appears to be on each division (right and left side) another bone now anchylosed with the posterior edges of each middle bone or inter-clavicle, and throwing off from their anterior edges a thin process or plate, which passes partially over the lower edges of the supra-clavicles and united to the anterior edge of each of the inter-clavicles, serving as a base for the supra-clavicles and for the attachment of their tissues.

Taking, as in the ventral fins, the shoulder-girdle, left side—removed from the body of the fish, the upper portion the supra-clavicle viewed from the outside has a two-fold* termination, the posterior fork passes freely, apparently without any ligamentous† attachment, into the fleshy tissue; measured in a direct line from base to point it is $2\frac{1}{8}$ inches in length, and its base is a little less than $\frac{5}{8}$ of an inch in breadth. It overlaps the inter-clavicle; at $\frac{5}{8}$ of an inch from its base, anteriorly, arises

*Three-fold, if looked upon as the same bones in the cod are usually accepted.

†I could not find any in three specimen .

another process having a cartilaginous attachment to it, this process is somewhat irregular in shape and rough upon its edges for the attachment of the tissue which unites it to the bones of the skull. It penetrates beyond the marginal point of the preoperculum and its tissues are connected with the edge of the supporting bone above the fleshy cheek behind the eye, in shape it is nearly straight, slightly curved laterally; from its junction with the supra-clavicle to its point it is about $1\frac{7}{8}$ inches in length; on the anterior edge of its projection or root this small bone is attached by cartilage to the bone which supports the operculum. To enable you to understand this junction I have cut off a small portion of bone from the skull leaving the cartilage entire. Let us turn this bone over and look at its inner face, at the point of junction of the small bone already noticed as supporting the upper portion of the supra-clavicle and diverging from it dorsally in a line with the centre of the root of the small or supra-clavicular bone is a *short* bone having a very strong ligament connecting it with the skull bone at the base of the brain, (it is this short bone which makes in the Cod fish the forked supra-clavicular bone, but it differs from the salmon inasmuch as it is throughout a bone and is not a representative of the process in the salmon which springs from the supra-clavicle,) a pin in the skull of the large skeleton marks the point of connection.

Of the middle piece or inter-clavicle there need not much be said, it is as the supra-clavicle thin and flat and its upper end is inserted under the edge of the supra-clavicle, on its anterior face for nearly $\frac{5}{8}$ of an inch, posteriorly it has a thickened striated edge; its lower extremity which is flat, thin and oval shaped overlaps and is attached to the clavicle, presenting the appearance of nearly concentric plates, the growth of which has taken place apparently from the inner side. In specimens freshly taken this bone has considerable freedom of motion upon the clavicle.

The Clavicle, Coracoid, Scapula, &c.

It is almost impossible for me to describe the shape of the clavicle and the bones connected with it, but I will make the attempt.

The clavicle from its inferior edge to the extremity of its anterior horn is in this specimen:— $2\frac{3}{4}$ inches in height; $3\frac{3}{4}$ inches in length, from posterior to anterior end, and measured on a line through its centre; the inter-clavicle is attached to it for about $1\frac{1}{4}$ inches, measured from the top of its anterior horn, and the shape of its superior extremity nearly corresponds to that of the inferior extremity of the inter-clavicle; on its inner side, near its posterior edge, there is slightly projecting from it a thin bony plate, terminating at the lower edge of the clavicle to which it is anchylosed, it has a narrow rounded end, this unites with the posterior edge of the accessory bone—its lower rounded end is close to it. The accessory bone arises about midway on the posterior edge of the clavicle, at the junction of the division of its thin posterior plates, and is anchylosed with it; it becomes gradually thicker for nearly one-third of its length and then decreases to its inferior end where it has the usual enlargement for its attachment to the strong muscular tissue in this part of the fish, its interior edge projects $1\frac{1}{8}$ inches below the clavicle, and its posterior edge $\frac{7}{8}$ of an inch. This accessory bone passes inside of the pectoral fin, and gives support to it; it is entirely different from that of the cod-fish in shape as well as attachment. In the cod, as you will see by the specimen (pectoral fin, clavicle, etc., shown), it is a free bone, lying loosely upon the upper posterior edge of the clavicle.

The scapula joins at its superior extremity the upper edge of the clavicle, and its inferior extremity the upper posterior division of the coracoid bone; its posterior inferior extremity is also attached by cartilage to the posterior edge of the bones, which represent the radius and ulna.

The coracoid at its posterior extremity is divided. Its upper edge is united with the scapula, as already mentioned; its lower limb, which is the longest, has its point attached to the inner central ridge of the clavicle, and it is pierced by two foramina, each of considerable size, one on either edge, outer and inner, the latter being the largest and oval in shape; the posterior edge of this lower limb is united by a band of very thin bone, which follows on the one side its shape, and on the other the outline of

the two nearly circular bones which represent the radius and ulna. The anterior extremity of the coracoid is somewhat twisted, that is, its inner and superior edge rises for its union by cartilage with the clavicle, which sends out from its central ridge a flat process for this purpose.

The Humerus.

If you will look at the under side of the coracoid bone, which on this aspect appears to be nearly flat and somewhat curved, from its posterior extremity to its junction with the clavicle; between the foramina already noticed you will perceive a central ridge, which expands towards its posterior extremity; about midway of its length there appears to be a transverse joining, or symphysis, and following this ridge posteriorly you will see that one edge of it forms the outer side of the inner foramen, and that there is a line or indentation which passes by the edge of the outer foramen to the transverse division from whence we started, this appears to me to be, without doubt, the humerus, but to be positive on this point requires the examination of very young specimens of the salmon, which I regret to say my sight will not permit me to undertake.

Carpal Bones and Pectoral Fin.

The pectoral fin is attached to four ossicles, or carpal bones, with the exception of the upper or long ray, which is directly articulated with the radius—the upper one of these ossicles and the shortest is attached to the ulna; the three lower to the posterior extremity of the coracoid, at the lower part of the bone which I regard as the humerus—all cartilaginously. The lower ossicle is $\frac{3}{4}$, the upper about $\frac{5}{16}$ of an inch in length.

The rays of the pectoral fin are fourteen in number. The first or upper ray is in length, from attachment to posterior extremity or point, $4\frac{3}{8}$ inches, the others gradually decreasing in length until the lowest and shortest is $1\frac{3}{8}$ inches. Looking at the fin on either side the rays are crowded, and set one within the other after the manner of a venetian blind when turned to keep out the rays of the sun, the inner inferior margin being the lowest. The upper or long ray, at its attached extremity is very much stronger than the others, and at this point it

has a wide articulating surface on its inner side or heel for its union with the radius upon which it moves, this surface is furnished with the usual lining and ligaments of such joints; from its inner to outer heel transversely it is in breadth $\frac{5}{8}$ of an inch.

Outer side of the pectoral fin.—The heel of the first or upper ray is $\frac{3}{8}$ of an inch in length, and nearly at right angles to its shaft, the heel inclining away from its supporting bone, and at the same time turned towards the ventral aspect of the fish. The heels of the remaining rays gradually increase their angles or have less abrupt curves until the last two or three rays, when their curves again become sharper, the lengths of all decreasing, but the outer heel of the lowest or short ray preserves nearly the normal shape, and projects an $\frac{1}{8}$ of an inch below the supporting ossicle. On its inner side the heel of the long ray is very stout, and its edge inclining downwards gives it a broad termination for the accommodation of the articular joint. The heels of the next six rays gradually decrease in their length and curves until the 8th ray is nearly straight; the 9th, 10th, 11th, 12th and 13th rays are also nearly straight, but closely crowded together, and the inner heel of the 14th is curved upward and almost overlaps the end of No. 13; the outer heel of 14 is, from outside to outside, $\frac{1}{4}$ of an inch below the inner extremity. All the rays are on each side attached to the base of the fin, by strong cartilage, which fills the division of or the space between the rays, so much so that without destroying the fin, which at present cannot be spared, it is impossible for me to give a more particular description of it.

At the junction of the clavicles, which are connected by cartilage and closely attached to their united ends by strong fatty tissue, is the urohyal bone, in this specimen it is $1\frac{3}{4}$ inches in length, and $\frac{3}{4}$ of an inch in height at its posterior extremity; at this point begins its ventral transverse plate, for half an inch of its length it is very narrow, but it rapidly widens until it attains $\frac{3}{8}$ of an inch, taking a lanciolate form. This bone is perpendicular to the body of the fish, and by its anterior end it is attached to the hyoid bones.

This brings us now to the head of the fish on the ventral

aspect, and my present task is done. I have endeavored to describe to you the bones of the salmon (*Salmo-Salar*) as they appear to me to be. I have no theory to advance or support, and it is too much to expect that in what I have read to you there is no error, but it may serve to help some enquirer on his way, and if such be the result my time will not have been spent in vain.

(*For Figures see Appendix.*)

ART. VIII.—NOVA SCOTIAN FUNGI. BY J. SOMMERS, M. D.

(*Read Jan. 26, '80.*)

THE present paper affords a very short list of some of the more common species of our mycological flora, the result of a three months' study of a local botanical region.

During the time very many specimens have passed through our hands. Difficulties in diagnosis, want of sufficient time, and the evanescent characters of many of them, have been important factors in determining the length of our list, but we have observed enough to convince us that the fungi are capable of affording a field for study which will take many years of patient and laborious investigation to render complete.

Viewed either from scientific or economic point, the fungi furnish us with interesting matter for study and comparison. Their organization, growth and reproduction afford matter for originality in their treatment by scientists. Their medical and nutritive properties—their parasitical and destructive tendencies supply matter for reflection on the part of the economist.

To the student of nature they are of interest, as situate on the border line between the dead and living things of earth—maintaining the balance of power, devourers of dead organic matter, destroyers of decaying organisms; they supply, also, a bountiful store for hosts of highly vitalized, organized beings, and are not even disdained by man himself.

The local peculiarities of our Province now existing, viz., its dense woods and extensive swampy barrens, furnish favorable conditions for the development of this class of vegetables, which our dry atmosphere would, under other conditions, seriously interfere