west Passage, which, from the known activity of that body, may be agreed too, and thus, in all probability, we shall hear of the American flag traversing the Polar Sea, and doubling Icy Cape. The Americans, by this achievement, would secure to themselves and deservedly, a splendid name in the annals of geographical discovery,—a name that ought to be ours, and which would add another and enduring laurel to the wreath of glory which surrounds the maritime honour of this nation.

Remarks on the Structure of some Calcareous Sponges. By Robert E. Grant, M. D., F. R. S. E., F. L. S., M. W. S., &c. Communicated by the Author.

THE *Spongia compressa* Fabr. Gmel. Lamouroux, (*S. foliacea*, Montagu), affords a good example of a species in which the axis is composed entirely of *calcareous* spicula. This is a small white tubular compressed species, generally about an inch in length; it hangs from the under surface of rocks by a thick short peduncle; it is entirely hollow, and opens by one or more marginal apertures at its pendent extremity; its parietes are of equal thickness throughout, nearly as thin as writing paper, and every where pierced with minute openings, which are visible to the naked eye on the external and internal surface, and its currents are distinctly visible, both those passing in through the pores, and those issuing from the large pendent orifices. It is a hardy species, growing in very exposed situations, and in cold climates. Fabricius observed it on the coast of Greenland, Professor Jameson and Dr Fleming on the shores of the Shetland Islands, Montagu on the coast of Devonshire, and I have found it very abundant in the Frith of Forth. They hang like small white leaves from the surface of rocks, at low-water mark, being always in a collapsed state, and their opposite sides in contact during the retreat of the tide; but, when suspended for a short time in pure sea water, their parietes separate, and they become like small distended bags pouring forth a continued and obvious current. The pores pass through their parietes in a direction a little oblique, from below upwards, and the margins

of the fecal orifices are surrounded with the projecting extremities of minute shining spicula. To the naked eye their external surface appears even and villous, and on tearing them open, their internal surface appears more compact, and the terminations of the pores are wider. On tearing a portion of this sponge into minute fragments, and examining them under the microscope, we find, in place of the *horny* tubular fibres of the *S. communis*, which Mr Ellis has compared to fine filaments of catgut, the whole axis composed of slender, shining, transparent spicula of regular and constant forms. Two forms of spicula are observed in this species, the one is tri-radiate, consisting of three rays of the same form and size, united at one point, and forming equal angles by their union; the rays are thickest at their point of divergence, and taper slightly to near their free extremities, where they are brought suddenly to a point. The rays of the tri-radiate spiculum are hollow within, shut at their free extremities, and have no superficial openings; but their internal cavities communicate freely at their point of junction, and form there a small central reservoir. These spicula vary much in size in the same individual, but their general length is about the sixth of a line, from the extremity of one ray to the extremity of another; and I have not observed any difference in their magnitude taken from specimens, one of which was ten times the size of the other. The other spiculum of the *compressa* is the clavate, which is broadest and rounded at one end, from which it tapers regularly to a point at the other; it is quite straight for two-thirds of its length from the pointed end, but the remaining thick part is bent so as to describe the fourth part of a circle. This spiculum is distinctly tubular, and shut at both extremities. The very small straight spicula, which we always observe along with these two, appear to be only broken rays of minute tri-radiate spicula. These spicula consist of carbonate of lime, and exhibit no trace of phosphate of lime, on employing the usual agents to detect its presence. When we examine with the microscope the arrangement of these spicula in the *compressa*, we observe two rays of the tri-radiate spicula contribute to form the polygonal pores, while the third ray serves to defend and maintain a space between the pores for the lodgment of the soft parts and ova of this animal; the curved

ends of the clavate spicula hang over and converge around the entrances of the pores, and seem to have a relation to that function. As these tubular spicula have no external opening, they cannot be the cells of polypi, or contribute in any way to produce the currents of this sponge.

The *Spongia nivea*, Gr. is a small sessile flat spreading species, of a pure white colour, which I have only found on the under surface of sheltered rocks at Prestonpans Bay, during the ebb of stream-tides: it is not very uncommon there; it appears like patches of mineral agaric, or rock-milk, on the roofs of small caves, is about two lines in thickness, spreads to the extent of one or two inches in diameter, and is smooth on the surface. Its pores are just visible to the naked eye, and its fecal orifices are regularly and beautifully constructed; there is a gentle rise of the surface to the margins of the fecal orifices, the margins are quite circular, and have thin transparent terminations; the orifices are never produced so far as to form distinct papillæ, and their currents are directed perpendicularly downwards, in the natural position of the animal. When the *nivea* is checked in its growth, and prevented from spreading by the crowding of other animals around it, its surface becomes waved, and in many places presents elevated sharp ridges, which allow a greater space for the distribution of the pores. (See specimens in the Museum of the University, *S. nivea*, Gr.) The axis of this sponge is composed almost entirely of large tri-radiate spicula, some of which are more than half a line in length, and thick in proportion; their forms are seen by the naked eye. These triradiate spicula occur of different sizes, to the minuteness of the fiftieth of a line in length, their rays taper regularly from their place of junction to their sharp-pointed extremities, their internal cavities are very distinctly seen in the large spicula. The second form of spiculum in the *S. nivea* is the most remarkable, though the rarest; it consists of a straight line, with two opposite lateral projections in its middle, which are generally a little curved. When these lateral processes are large and straight, it becomes a regular quadriradiate spiculum, but they are generally much shorter than the other two rays; and when they are placed near one extremity of the spiculum, it appears under the microscope like a small dagger with a

handle. The quadriradiate spicula are generally very minute, and in number about one to a hundred of the triradiate. The third kind of spiculum in this species, is a very minute straight equally thick spiculum, obtuse at both ends, and generally about the fiftieth of a line in length; this form is very abundant, and may possibly be derived from the broken rays of very small triradiate spicula, as in the *compressa*. These three kinds of spicula are likewise calcareous, and dissolve with rapid effervescence on being touched with diluted nitric acid. On looking closely into the surface of the *S. nivea*, with a single lens, we perceive that the large triradiate spicula lie parallel with the surface, and contribute to form and protect the pores.

In a portion of the *Spongia complicata* of Montagu, sent me, along with fragments of nearly thirty other species of British sponges, by the Rev. Dr Fleming of Flisk, who has collected and studied the British zoophytes for upwards of twenty years, I observe the axis to consist entirely of very minute triradiate spicula, which dissolve rapidly with effervescence, when touched with nitric acid. Dr Fleming mentions this species as an inhabitant of the Frith of Forth, and considers it a variety of the *S. botryoides* of most authors. The triradiate spiculum not only occurs alone, and very small, in this species, but is quite peculiar and very imperfect in its form; the rays are very short and disproportionally thick; they often diverge at unequal angles, and, on viewing the spiculum sideways, they are seldom found to lie in the same plain. This sponge has a white colour, like the other calcareous species, and, when dry, the spicula on its surface have the same shining silvery lustre. The triradiate spicula of the *S. botryoides* were figured and described by Mr Ellis, and have been mentioned by most writers since his time. Montagu and Lamouroux have very judiciously introduced the forms of the spicula into their definitions of this species; and in order to distinguish them from the triradiate spicula of the *S. complicata*, Montagu mentions that they are more than four times as large as those of the latter sponge. From having invariably found the triradiate spiculum present, either alone or combined with other forms, in calcareous sponges, I have no doubt that the true *S. botryoides*, if distinct from *S. complicata*, will be found to have a calcareous axis. A portion of another

species, presented me by Dr Fleming, under the name of *S. pulverulenta*, presents two kinds of spicula, both of which effervesce and dissolve quickly in nitric acid; one of these forms is a triradiate spiculum with long and very slender rays diverging at equal angles; the other is a very long straight needle-shaped spiculum, pointed acutely at one end, and obtuse at the other. This calcareous species agrees with the others in its white colour, and the silvery lustre of its spicula, when dry. The *Spongia coronata* is the most minute and the most perfectly constructed of all the calcareous sponges I have yet met with. It has two kinds of spicula, the one triradiate, and the other needle-shaped, both of which dissolve quickly with effervescence in diluted acids. The triradiate spicula are more equal in size than in the other species, and are models of this form for their symmetry and proportions; the rays are straight, slender, and diverge equally; they are cylindrical, transparent, and acutely pointed. The needle-shaped spicula are about twice as long as the triradiate, slender, transparent, cylindrical, rounded at one end, and pointed acutely at the other. This sponge is almost microscopic; several entire specimens of it, presented me by Dr Fleming, are not half a line in length; they agree with the others in their colour, and the lustre of their spicula. The long needle-shaped spicula cover the whole surface, like filaments of white silk, and are obviously destined to defend the pores and the fecal orifice, which is proportionably large. On removing these projecting needle-shaped spicula from the surface, which may be compared with the clavate spicula of the *S. compressa*, we observe that the triradiate spicula are entirely devoted to the formation of the pores and passages leading into this animated tube.

There are thus at least six well marked species of British sponge, in which the spicula consist entirely of carbonate of lime, which forms an important character of distinction between these species, and those containing a horny or a siliceous axis, and shows an approximation in this obscure genus to the more solid polypiferous corals, which, so far as I know, has hitherto escaped notice.