at both ends as a *tylote* (fig. 13 *b*) ; the tylote if pointed at one end is a *iylotoxea* (fig. 13 *d*) ; the strongyle similarly becomes a *slrongyloxea.* These last two forms are with difficulty distinguished from the stylus, which is usually pointed at the end, and strongylate (fig. 13 *f*) or tylotate (fig. 13 *e)* about the origin. A particular case of the cladose rhabdus, but one of the most frequent occurrence, is the *triæne* ; in this form one ray of a rhabdus ends in three branches, which diverge at equal angles from each other. The rhabdus then becomes known as the shaft or *rhabdome,* and the secondary rays are the arms or *cladi,* collectively the head or *cladome* of the spicule. The arms make different angles with the shaft : when recurved a grapnel or *anatmæne* is produced (fig. 13 *k),* when projecting forwards a *protriæne* (fig. 13 *l*), and when extended at right angles an *ortho- triæne* (fig. 13 *m*). The arms of a triæne may bifurcate *(dichotriæne)* once (fig. 13 *n*), twice, or offener, or they may trifurcate. Again, they may extend laterally into undulating lamellæ, or unite to form a disk, the triæne character of which is indicated by the included axial fibre. The shaft may also become trifid at both ends, *arnphitriæne* (fig. 13 *p),* and the resulting rays all bifurcate, or the cladome may arise from the centre of the rhabdome, *eentrotriæne* (fig. 13 *o).* Amongst one group of Lithistid sponges *{Rhabdocrepida)* the normal growth of a strongyle is arrested at an early stage ; it then serves as a nucleus upon which further silica is deposited, and in such a manner as to produce a very irregularly branching sclere or desma (fig. 13 *s*), within which the fundamental strongyle can be seen en­closed. In such a desma no axial fibre besides that of the enclosed strongyle is formed.

The chief modification of the triradiate spicule is due to an elonga­tion of one ray, distinguished as *apical,* the shorter paired rays being termed *basal,* and the whole spicule a sagittal triradiate. The angle included by the basal rays is usually over 120° (fig. 14 *a).*

Some or all of the rays of the primitive calthrops (fig. 14 *b*) may

subdivide into a number of terminal spines *candelabra* (fig. 14 *c*) ; or some or all of them may bifurcate once or twice and finally terminate by subdividing into numerous variously shaped processes ; such a *tctracladine* desma (fig. 14 *e)* characterizes one division of the Lithistid sponges.

By the excess or defect of one or more rays a series of forms such as are represented in fig. 15 arise. In the oxea, which results from

the suppression of all rays but two, the Sexradiate character is some­times preserved by the axial fibre, which gives off two or four pro­cesses in the middle of the spicule where the defective arms would arise. Let fig. 12 *e* represent a regular Sexradiate spicule with its four horizontal arms extended beneath the dermis of its sponge ; the over-development of the proximal ray and a reduction of the distal ray produce a form known as the *dagger* (fig. 15 *a*); the suppression of the proximal ray and the development of spines pro­jecting forwards on the distal ray produce the *pinnulus* (fig. 15 *b,* *c*) ; the suppression of both proximal and distal rays gives the *staurus* (fig. 15 *f*), and the suppression of two of the remaining horizontal rays a dermal rhabdus (fig. 15 *g).* The suppression of a distal ray, excessive development of a proximal ray, and recurved growth of the remaining rays produce an *anchor.* In *Hyalonema* (glass rope sponge) anchors over a foot long occur, but their arms or teeth are not restricted to four, and the axial fibre gives off its processes before reaching the head of the spicule. Such a grapnel helps to support the sponge in the ooze of the sea-bed. Other character­istic spicules belonging to sponges distinguished by Sexradiate spicules are the following :—the *uncinaria* (fig. 16 *a*), a spinose

oxea with the spines all pointing one way ; the *clavula,* a tylotate form with a toothed margin to the head (fig. 16 *b*); the *scapularia* (fig. 16 *c*), a besom-shaped spicule with tylotate rays, which vary in number from two to eight ; the *amρhidisk* (fig. 15 *d*), a shaft terminating at each end in a number of recurved rays. When the Sexradiate spicules of the *Hexactinellida* unite together in a manner to be described later, the rays may be bent in a variety of ways out of the triaxial type, so that the Sexradiate character alone remains.

*Multiradiate Type.—*The rays of an aster as of other spicules may be spined or tylotate. In one remarkable form known as a *sterraster* (fig. 12 *g, h),* and characteristic of the family *Geodinidæ,* the rays are almost infinite in number, and coalesced for the greater part of their length ; the distal ends, however, remain separate, and, becoming slightly tylotate, are produced into four or five re­curved spines, which give attachment to connective tissue fibres by which adjacent sterrasters are united together.

In one aberrant group of Lithistid sponges (*Anomocladina)* the skeleton is formed of desmas, which are multiradiate, each present­ing a massive centrum (with an included cavity) produced into a variable number (4 to 8) of rays, which rays terminate in expanded ends (fig. 12 *f*).

It is doubtful whether a distinction between megascleres and microscleres can be maintained in the calcareous sponges, unless the minute oxeas which occur in *Eilhardia sehulzei,* Pol. (*16*), are to be referred to this group. They are widely distributed through­out the silicious sponges, and by their different forms afford charac­ters of the highest importance in classification.

One of the simplest forms is the *sigmaspire* (fig. 17 *a*, *b*) ; it looks like the letter C or S, according to the direction in which it is

viewed, its actual form being that of a single turn of a cylindrical spiral. A turn and a part of a turn of a spiral of somewhat higher pitch than that of a sigmaspire gives the *toxaspire* (fig. 17 *c*); a con­tinued spiral growth through several revolutions gives the *pοlyspire.* The sigmaspire becoming spined produces the *spiraster* or *spinispirula* (fig. 17 *d)* ; this, by losing its curvature, becomes the *sanidaster* (fig. 17 *e),* and by simultaneous concentration of its spines into a whorl at each end, the *amphiaster* (fig. 17 *f*). By reduction of the spire the spiraster passes into the *stellate* or *aster* (fig. 17 *n*). A thickening about the centre of the aster produces the *sρheraster* (fig. 17 *m),* allied to which is the sterraster. By a reduction in the number of its rays the aster becomes a minute calthrops, from which, by increased growth, the skeletal calthrops may very well be derived ; by further reduction to two rays a little rhabdus or microrabd re­sults, and of this numerous varieties exist, of which the oxeate microrabd is the most interesting, since it only differs in size from the commonest of all skeletal spicules, the oxeate or acerate rhab­dus. The sigmaspire is formed as a superficial spiral thickening in the wall of a spicule cell or scleroblast ; as superficial deposits also the next group of spicules, the so-called *anchorates,* arise. Take a hen’s egg as the model of a scleroblast, draw round it a broad meridional band, interrupted only on one side, for 30° above and below the equator ; this will represent a truly C-shaped spicule, which differs from a sigmaspire by the absence of spiral, twist. It may be termed a *cymba* (fig. 17 *g).* The back of the “ C ” is the *keel* or *tropis* ; the points are the *prows* or *proræ.* Now broaden out the prora on the eggshell into oval lobes (p*roral pteres)* ; and from each pole draw a lobe midway between the prora and the tropis (*pleural pteres),* and a common form of anchorate, the *pterocymba*