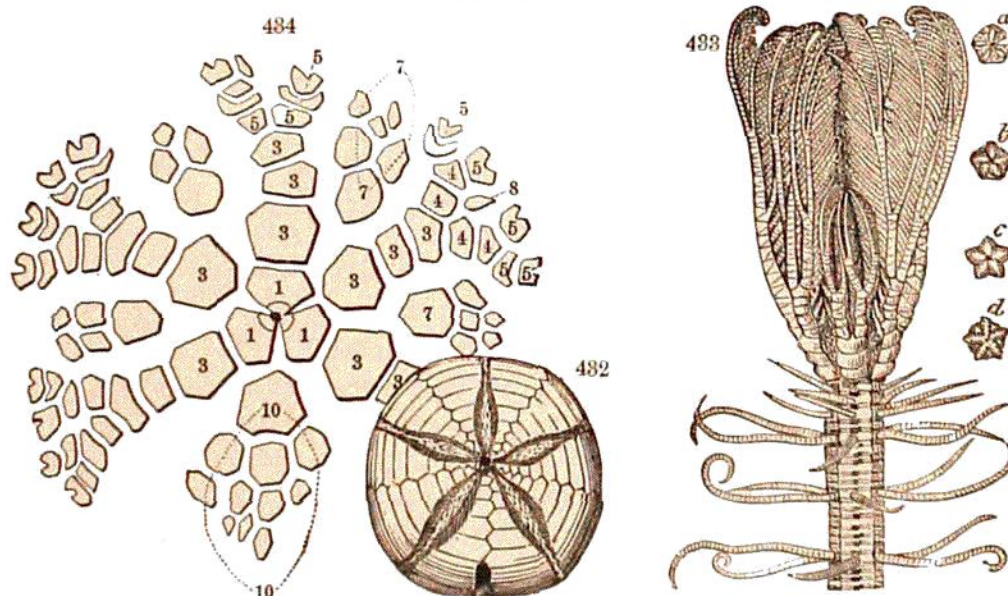


2. **Echinoids** (*Sea-urchins*). — Having a thin and firm hollow shell, covered externally with spines (Fig. 441); form, spheroidal to disk-shape; the mouth below, at or near the center, as the *Echinus*. Fig. 441 represents an *Echinus* partly uncovered of its spines, showing the shell beneath, and 432 another, wholly uncovered. The shell consists of polygonal pieces, in 20 vertical series, arranged in 10 pairs, except in species of the Paleozoic. Five of these 10 pairs are perforated with minute holes, and are called the *ambulacral* series (*a* in Fig. 441 represents one pair); and the other 5, alternating with these, are called the *inter-ambulacral* (*b*). The inter-ambulacral areas have the surface covered with tubercles, and the tubercles bear the spines, all which are movable by means of muscles. The ambulacral have few smaller tubercles and spines, or none; but over each pore (or rather each pair of pores) the animal extends out a slender fleshy tentacle or feeler, which has usually a sucker-like termination and is used for clinging or for locomotion. In Fig. 432, the inter-ambulacral areas are broad and the plates large, but the ambulacral are narrow and the plates indistinct. The *mouth*-opening is situated below, at the center of radiation of the plates. The *anal* opening in the *Regular* Echinoids (Fig. 441) is in the opposite or dorsal area or center of radiation. Around the dorsal area there are 5 minute genital openings. In the *Irregular* Echinoids — constituting a large group — the *anal* opening is to one side of this dorsal center of radiation, and often on the ventral or under surface of the animal. In Fig. 432, for example, the anal opening is marginal instead of central, while the genital pores are around the dorsal center, as in the *Regular* Echinoids. To one side of the dorsal center in the *Regular* Echinoids, there

432-434.



ECHINODERMS. — Fig. 432, an *Echinus* without its spines, — the *Clypeus* Hugi of the *Oölyte*; 433, the living *Pentacrinus caput-medusæ* of the West Indies ($\times \frac{1}{2}$); *a, b, c, d*, outlines of the stems of different species of *Pentacrinus*; 434, plates composing the body of the Crinoid, *Batocrinus longirostris*.

is a small porous prominence on the shell, often called the *madrepore* body, from a degree of resemblance in structure to coral. In some of the *Irregular* Echinoids, this *madrepore* body is in the center of dorsal radiation.

The ambulacral areas are sometimes equally perforated throughout their length. But in other cases only a dorsal portion is conspicuously perforated, as in Fig. 432, and, as this portion has in this case some resemblance to the petals of a flower, the ambulacra are then said to be *petaloid*. A large part of Echinoids have a circle of 5 strong, calcareous jaws in the mouth; in a portion of the *Irregular* Echinoids there are *no* jaws.

3. **Asterioids** (*Star-fishes*). — Having the exterior stiffened with articulated calcareous granules or pieces, but still flexible; form star-shaped or polygonal; the viscera extending