centriole or clear area, and is filled with dense uniform granules, the diatom structure we describe is not a typical centrosome. We have not seen it in other diatoms, either centric or pennate. Our observations may support the idea of Lauterborn that the spindle is formed outside the nucleus in some diatoms, perhaps in a manner analogous to that found in some flagellates (*6; 7*).

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Invertebrate Ferritin: Occurrence in Mollusca

Abstract. *Ferritin, in both crystalline and paracrystalline forms, occurs in the columnar epithelial cells of the dorsal wall of the radula of the marine chiton* Cryptochiton stelleri, *order, Polyplacophora. The ferritin occurs in association with the magnetite of the radular teeth. It has been isolated and crystallized in the presence of cadmium sulfate.*

Ferritin is an iron-protein complex which acts physiologically as an iron storage mechanism. It has the approximate composition $(FeOOH)_8 \cdot (FeOPO_3H_2)$ (*1*), and contains about 20 percent of iron, dry weight. Ferritin was first isolated from horse spleen by Laufberger (*2*) in 1937 and subsequently has been the subject of intensive research (*1, 3*). It has been reported to occur in a variety of organs and cells of many vertebrates. It is commonly found in the spleen, liver, bone marrow, and kidney, and has also been observed in the ameloblasts associated with maturing enamel in rat incisors (*4*). Among the invertebrates, Roche *et al.* (*5*) reported the occurrence of small amounts of ferritin in the chloragogen cells of the polychaete worm *Arenicola marina.* In flowering plants a similar protein, phytoferritin, has recently been identified and localized (*6, 7*). We have recently isolated ferritin from the columnar epithelial cells of the radula of the marine chiton, *Cryptochiton stelleri.*

Iron was reported to occur in high concentrations in the denticles of the lateral radular teeth of the primitive molluscan chitons (Polyplacophora) (*8*). Lowenstam (*9*) used x-ray diffraction techniques to show that the iron in the mineralized denticles occurs, in some species of chitons, in the form of the mineral magnetite ($Fe_2O_3 \cdot FeO$), while in others it occurs as magnetite plus minor amounts of undetermined minerals. This was the first indication that iron is biologically precipitated in crystalline form as the ferric-ferrous compound, which is otherwise known as a common mineral formed by inorganic precipitation processes in igneous and metamorphic rocks.

In the radula of any individual chiton, the total number of denticles is considerable and, because of wear and loss, the anterior denticles have to be replaced very frequently. Hence there must be a continual supply of iron available for denticle formation (aside from that required for hemeprotein formation). According to most investigators, the radular teeth of molluscs are formed posteriorly in the radular sac by the odontoblast cells (*10*). When they have been formed and have moved anteriorly on the radular sheath, min-

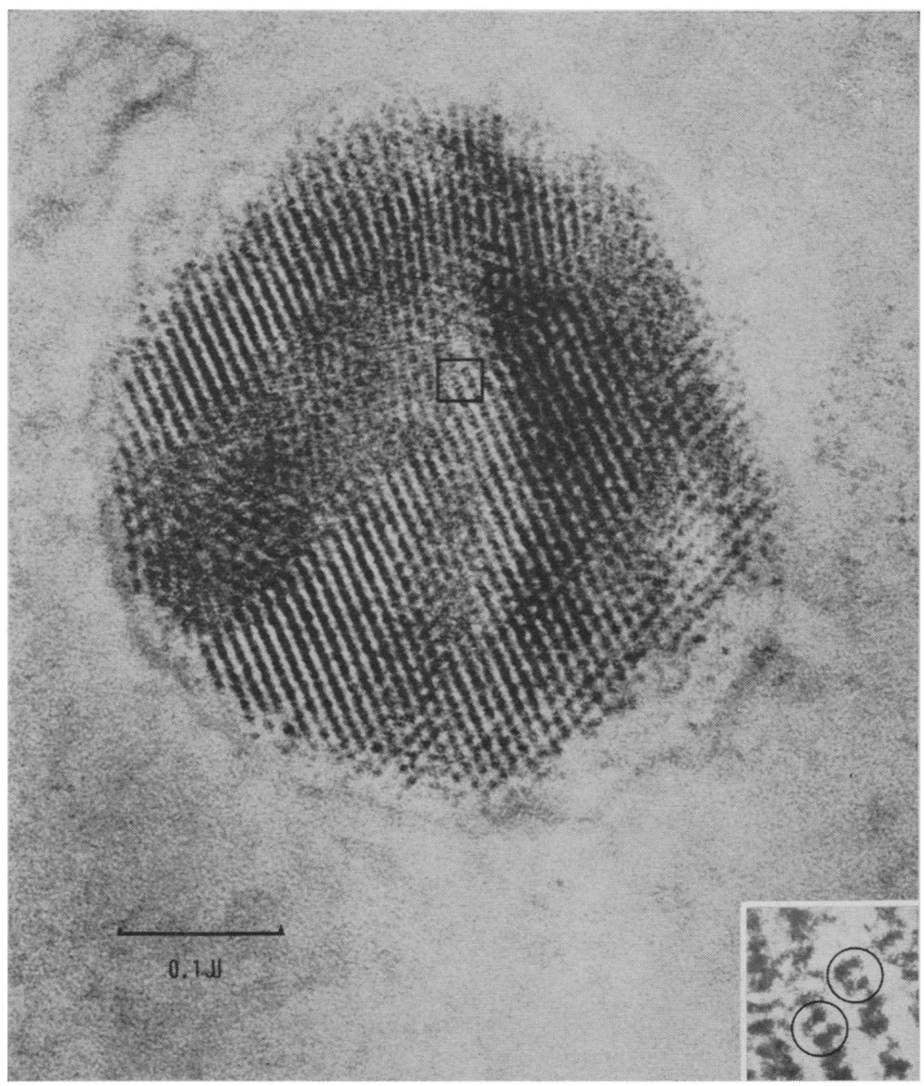

Fig. 1. Electron micrograph of a section of crystalline ferritin in the columnar epithelial cells of the dorsal wall of the radula of *Cryptochiton stelleri* (about × 206,000). Inset: Higher magnification of the crystal showing characteristic profiles of the individual iron micelles (about × 635,000).

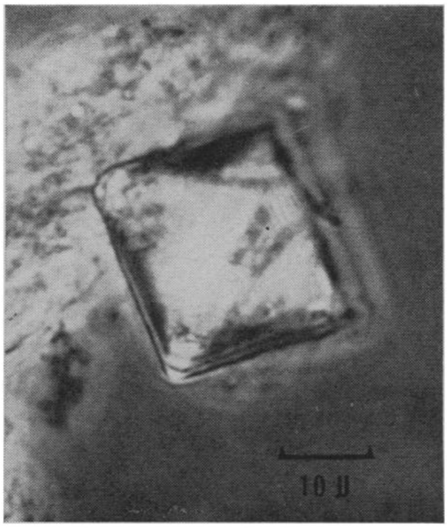

Fig. 2. Photomicrograph of a typical yellowish-brown, octahedral ferritin crystal (about × 1100).

eralization occurs by intussusception from the cells of the dorsal epithelium in the radular sac (*10*). Histochemical studies of the dorsal radular epithelium from several species of chitons have revealed the presence of iron granules which stain specifically for ferric iron (*11*). We considered that these iron granules might contain ferritin and therefore studied, with an electron microscope, the upper epithelium of the radular sac in contact with the denticles, from the species *Cryptochiton stelleri*.

The entire radula was removed from a mature individual (*12*) and immediately fixed in cold, 2-percent osmium tetroxide buffered with veronal acetate. After 2 hours in the fixative the radula was run through a series of graded alcohols. When in 70-percent ethanol, the immature teeth and associated tissues were carefully excised from the distal portion of the radula and trimmed. The teeth were embedded in Epon 812 from absolute ethanol after infiltration with propylene oxide. The resin was polymerized at 60°C. Sections were cut with glass knives on an LKB Ultrotome and examined in a Philips EM-200.

Study of the columnar epithelial cells of the dorsal wall of the radular sac revealed the presence of numerous dense, granular bodies situated 6 to 8 μ from the contact between the cells and the wall of the radular tooth. Closer inspection of electron micrographs enabled us to classify these circular and oval bodies as either crystalline or paracrystalline types (Fig. 1 and the cover picture, respectively). The paracrystalline forms occur more frequently. The granules in these bodies are morphologically identical to normal ferritin (*13*). The iron micelles measure 55 to 60 Å across and, under certain conditions of orientation, characteristic subunits are sometimes resolved (Fig. 1, inset). In addition, the molecular micellar lattice (<30 Å) can be seen in the left-central portion of the ferritin crystal of Fig. 1.

Small amounts of the ferritin were isolated from the extracts of the dorsal epithelial cells from several radulae by Granick's modification (*14*) of Laufberger's original method (*2*). Minute, yellowish brown, octahedral crystals (Fig. 2) formed after several days in 5-percent cadmium sulfate solution. The characteristic ferritin crystals were soluble in 2-percent ammonium sulfate and could be recrystallized in 5-percent cadmium sulfate.

Work is in progress to characterize further this invertebrate ferritin and to establish its relationship to the formation of the magnetite of the radular teeth. In view of its occurrence in these primitive molluscs and in polychaete worms we are in agreement with Hyde *et al.* (*7*) who feel that ferritin is an ancient protein from an evolutionary standpoint. It will probably also be found in a variety of other invertebrates (*15*).

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Cesium-137 in Alaskan Eskimos

Abstract. *During the summer of 1962, levels of radioactivity in over 700 people at four villages above the Arctic Circle in Alaska were measured with a transportable whole-body counter. The averages for body burden of cesium-137 were much higher than the average for people in the rest of the United States. The people of the interior village of Anaktuvuk Pass had the highest average burden of cesium-137, which was 421 nanocuries; the maximum burden was 790 nanocuries.*

Members of the Hanford Laboratories have participated since 1959 in a bioenvironmental study program in the Cape Thomson area of northern Alaska as part of the Atomic Energy Commission's Project Chariot. One of the early results of these studies was the discovery of high levels of cesium-137 in lichens and caribou. This finding stimulated interest in the body burdens of isotopes from fallout in Eskimos in that area. Attempts to obtain autopsy samples of these Eskimos met with very limited success. In the fall of 1960, high body burdens of Cs^{137} were discovered in Norwegians (*1*) and subsequently in Swedish Lapps (*2*). The high burdens in these Lapps were thought to be connected with the food chain—from lichen to reindeer to man. During this period, a shadow-shield whole-body counter was developed at the Hanford Laboratories for other purposes. This counter was light and was so constructed that it could be readily transported.

During the summer of 1962 the counter was taken to northern Alaska, and the body burdens of over 700 people were measured. The counter was taken to the coastal villages of Kotzebue, Barrow, and Point Hope and to Anaktuvuk Pass, a village in the heart of the Brooks Range. Counts