fake. They tested its specific gravity, its composition, and its hardness, but all to no avail; and when at last they boycotted cultured pearls it was without valid reason.

The newspaper *London Star,* for May 4, 1921, said that certain merchants were selling Japanese cultured pearls so skillfully made that without cutting them in half it was impossible to distinguish between them and natural pearls. The report went on to say that because of the appearance of the cultured gem, not only the pearl, but the entire jewelry market was in turmoil. In their frantic attempts to discredit the cultured pearl, European merchants at the London Chamber of Commerce said that they were determined to treat the Japanese product as a fake because its appearance on the market had caused changes in the prices of natural pearls. In France, the cultured pearl met persecution until a famous naturalist held final judgement on the matter; the decision was in favor of cultured pearls, the clamor died down, and the cultured pearl received the recognition it deserved.

3. PEARLS OF THE WORLD

Although the success of Japan's cultured pearl leads many people to believe that pearls today are a strictly Japanese product, this is false. Many regions of the world produce natural pearls. For instance, along the shores of the Yangtze River, the Chinese have long taken pearls from freshwater mussels (*Cristaria plicata*). In fact, since the thirteenth century, they have used these mussels to produce small pearl-covered images of the Buddha. A lead image is slipped between shell and mantle, and the animal is returned to the water until a coating of pearly nacre forms over the image. This is, in effect, the process by which natural blister pearls are formed. Clearly, in the production of blister, or half pearls, the Chinese were well in advance of the Japanese. Indeed the pearly images are mentioned as having been produced in the vicinity of Canton as early as the Han period (100 B.C.). I myself recently bought one of the small pearl-covered Buddhas in a shop in Hong Kong. It had been made in a black-winged pearl oyster (*Pteria penguin*).

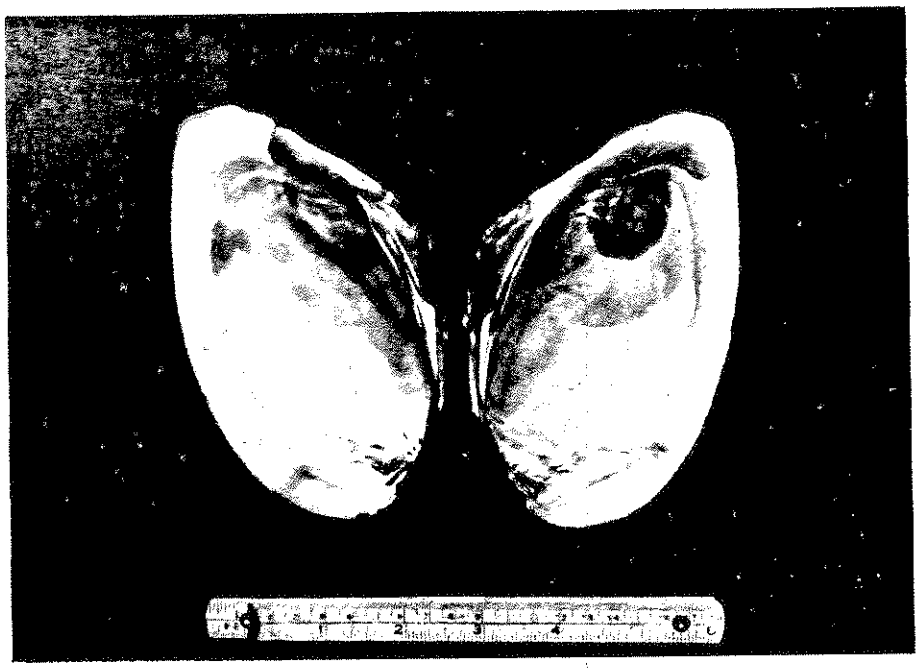
In recent years, experiments were made in Hong Kong with both black-winged and Akoya pearl oysters (*Pinctada fucata*) imported from Japan, but because of the relatively poor quality of the nacre and because of a lack of technical skill both attempts were halted before any noteworthy results had been achieved.

Until not very long ago, it was felt that since the Akoya pearl

method of culturing pearls; and the young man resolved to begin experimenting in the fall of that year. In the following year, however, the red tide killed off five thousand experimental oysters. Nevertheless, undaunted, Mikimoto continued his work until 1893, when he achieved success. The method was then patented and made public in 1896. Unfortunately, these early pearls were only of the blister or half-pearl variety, and they were cheaper and less marketable than natural pearls of the same kind. Work to produce a perfectly round cultured pearl continued; and in 1907, Tatsuhei Mise, of Matoya, Mie Prefecture, succeeded.

Though the work of these two men was of great significance, in fact, the method used throughout Japan today is the one developed by Tokichi Nishikawa, a government scientist employed at the Misaki Marine Biological Laboratory of Tokyo Imperial University (present Tokyo University). His process follows these lines: a piece of the mantle of a living oyster is cut off and inserted together with a suitable nucleus into the living organism of another oyster. The method is

4. A memorial to pioneers of the cultured pearl industry Tokichi Nishikawa, Kokichi Mikimoto, and Tatsuhei Mise at Kashikojima, Mie Prefecture.



9. A pearl-producing freshwater mussel.

custom continues in some parts of Micronesia and Melanesia. Obviously, natural pearls from oysters, whose shells themselves are considered valuable, command great prices on the world jewelry market.

The last of the three most important pearl-oyster groups is the silver-lipped pearl oyster (*P. maxima,* Jameson, 1901) found only in the deep waters of an area extending from Burma to Thailand, the Philippines, Indonesia, and Australia. Although divers are necessary to gather them, from long ago, their mother-of-pearl has been prized for ornaments and jewelry because of its beautiful, silvery-white luster. Diving operations to retrieve the oysters were especially important in the Arafra sea off the northern coast of Australia, but after the Second World War, the boats had rotted and pearl culture came to take the place of the older mother-of-pearl industry. The pearls produced in these large oysters, commonly called *Nanyo-dama* (South Sea pearls), are sometimes more than ten millimeters (about 7/16 inch) in diameter, but since they do not occur in large numbers, their prices are high. At present, Australia, the Philippines, Thailand, Indonesia, and Burma are engaged in culturing pearls in silver-lipped pearl oysters. In addition to these three leading varieties of pearl oyster, certain other mollusks are used in the industry.

The *Hyriopsis schlegeli* (Simpson, 1914) a freshwater mussel found

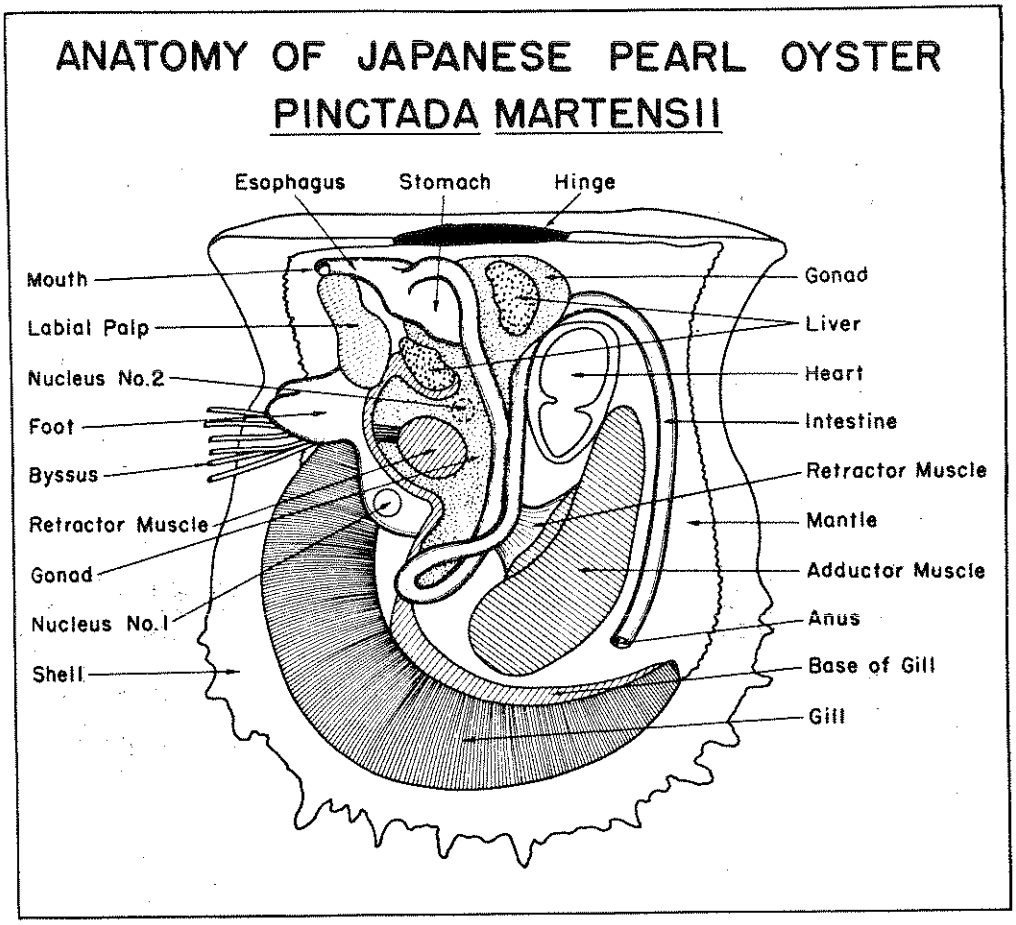
When sweat comes from the skin it is neutral, but it gradually acidifies and can then roughen the surfaces of pearls and dull their luster.

In contrast to the hard calcium of shells and pearls, the living body of the Akoya oyster is from eighty to ninety percent water but contains proteins and a very small percentage of fat. Proteins, composed of approximately thirteen amino acids, vary in composition with the season. Furthermore, the carbon in seawater is an important source of glycogen, a polysaccharide that is easily stored for sudden bursts of energy when needed. In this sense, the Akoya oyster is a highly nutritious food, just as is the ordinary edible oyster. The interesting thing, however, is how this wholesome, though unpalatable, soft creature produces the gleaming hard pearl.

3. FORMATION

The Akoya oyster feeds on the detritus of myriads of tiny organisms called plankton—more accurately animal, or zooplanktoh, and vegetable or, phytoplankton—and from these it obtains part of the calcium required to form shell and pearls. But since this is insufficient the creature must eke it out by taking in calcium dissolved in seawater (about three to five hundred milligrams per liter). This calcium passes through the mollusk's mantle to be deposited on the surface of the shell, or pearl, in the process of formation.

An open pearl oyster reveals a translucent marginal zone of mantle near the edge of the shell. In the outer section of this zone are three folds, the most outward of which secretes the shell material. The epithelium of this fold secretes the aragonite and calcite which give the inner layer of the shell and the surface of pearls their characteristics. In culturing pearls, a small part of this epithelium is cut from one living oyster and introduced into the body of another, where it continues to live and function. In other words, the small piece of epithelium cut from the oyster is inserted with a suitable nucleus, which it envelopes and gradually coats with nacre. The pearl sac that the epithelium forms around the nucleus is much like the womb around an embryo. The size of the piece of epithelium inserted with the nucleus is of great importance in determining the quality of the pearl. If it is thin (from two to ten microns), the surface of the pearl will be mostly translucent, glowing aragonite. On the other hand, if it is more than twenty microns thick, the resulting pearl will be dull and badly colored. The difference in the crystaline natures of calcite and aragonite determine the beauty of the pearl.



16. The anatomy of the Akoya pearl oyster. (*From* Pearl Culture in Japan, *Natural Resources Section Report No. 122, General Headquarters, SCAP, 1949*)

17. A microscopic view of a section of the pearl oyster epithelium.

3. INSERTING THE NUCLEUS

Until only recently, this was considered the key to the entire pearl culture business, but the occurrence of lumps of unappealing shell in place of pearls in oyster treated by the most skilled technicians led to further study and to the realization that the condition of the oyster before the operation is probably of even greater importance. A doctor will not submit a patient to a serious surgical operation until he is sure that the person is free of symptoms of other illness and that his physical condition is excellent. Similarly, a pearl oyster should not be forced to withstand the shock of nucleus insertion unless it is as fit as possible. After all, several millimeters of spherical shell in the abdomen of the small Akoya oyster is equivalent to a stone the size of a football in the human stomach. No matter how low the mollusk on the scale of living beings, in order to produce a good pearl, the oyster itself must be strong and healthy. Selection is of course important, but equally vital is the process called forced ovulation.

Since oysters are best able to withstand nucleus insertion after they have rid their bodies of sperm and eggs, this process is artificially forced in the following manner. A basket made of bamboo is filled

32. Baskets are filled with oysters for the forced ovulation required before nucleus insertion can be performed.