

OCCUPATIONAL DISEASES OF THE FISHERMAN*

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First of all I would like to express my sincere thanks to the College of Medicine of the University of the Philippines and the Institute of Hygiene for the invitation to speak before this audience. The opportunity to do so is a great honor and a genuine pleasure to me.

It was not easy to select an appropriate theme from the vast field of industrial medicine. I have chosen the occupation of the fisherman and the work in the fish industry because fish as a source of food is becoming increasingly important for Germany with its dense population and small territory, and this industry is also very important for Asiatic countries such as the Philippines with its extensive coast line and growing population.

The mortality of European fishermen is statistically lower than that of the general population, a fact which is attributed to the good physical condition and the work in pure air free from dust and microorganisms. The comparatively low susceptibility to tuberculosis is explained in the same manner by Germany's Nestor of industrial medicine, Franz Koelsch. On the other hand, however, there are a number of occupational diseases to which fishermen are exposed. The most well known of them is seasickness, in which a disturbance of the vegetative nervous system results from the rolling, rocking and stamping motion of the boat. This disturbance may be traced to an abnormal stimulation of the labyrinth by the displacement of the endolymph and to the tug on supporting tissues and ligaments of the intestinal organs, which results in an irritation of sympathetic centers of the upper abdomen. Today we know that these vegetative irritations are conducted to the nuclei of the vagus nerves and vegetative centers of the central nervous system. This in turn leads to a derangement of adrenal function via the sympathetic and of pancreatic secretion via the vagus nerves.

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A general occupational lesion of fishermen is the so-called "seamen's skin." Due to the influence of weather, solar radiation and salt water, the skin is usually severely tanned, the exposed parts of the skin are initially thickened, later atrophic, rich in pigment deposits or areas of depigmentation, with a tendency toward the formation of cancroids. Histologically, the typical alterations consist in severe hyperkeratosis, broad proliferation of epithelium into the deep layers of the skin, cleavage of the basal and lowest layers of prickle cells, multiform alterations of cell nuclei and inflammation of subepidermal connective tissue. Thus I was able to find an 80 times higher incidence of cancer of the face and lips at the Cancer Institute of Lisbon on the Portuguese seacoast than at the cancer institute of the inland city of Berlin. Cancer of the lips as an occupational disease of fishermen was described by Shambaugh among the fishermen of Massachusetts, who held the tarred nets between their teeth while spreading them out or took tarred needles into their mouth.

Cellulitis or furunculosis are further occupational diseases of fishermen, since the hygienic facilities are often inadequate in the narrow quarters of the fishing boats. This condition leads to more contact and smear infections. Deep stab injuries are often produced by the ends of steel trusses and the tips of wire roping. These injuries may result in secondary infection and phlegmonosis. Stormy weather, wind, cold and rain produce rheumatoses (muscle rheumatism, arthritis, lumbago, sciatica); this group of disorders ranges high in frequency. Next in frequency are respiratory diseases. In the cold seasons, chilblains and localized frost injuries constitute a hazard for fishermen.

According to the Swedish author Strindberg, a typical occupational disease of fishermen is homosexuality, which he also designated as an occupational disease of European monks. This most likely applies especially to the fishermen out at sea for long periods, for instance in the Arctic or on whaling expeditions.

Imbalanced diet and the consumption of large quantities of concentrated alcohol and tobacco not infrequently produce disturbances in European fishermen. Gastritis and ulcers of the intestinal tract are fairly common.

Among the crew of two fish cutters, a total of 6 men, a curious acute disease was observed following the ingestion of tuna fish liver, which has been attributed to the unusually high intake of vitamin D and A. Tuna fish liver is used in the pharmaceutical industry for the production of vitamins; 100 grams of tuna fish liver contain approximately 400,000 units of vitamin D. The fishers had eaten 100-400 gm. per man. According to their reports, the severity of the disease had been dependent on the amount of liver which they had eaten. The first symptoms appeared 4 hours after the meal in the form of acute headache and severe nausea. Later, a totally adynamic condition, pain of the larger joints, neck pain and meningismus followed. In all cases edema of the face appeared. The fishermen named their disease "thick head." There was a loss of appetite. Urinary excretion was very low during the first hours of the acute condition. The urine had a grass-green color. Conspicuously, the symptoms of the disease subsided rather quickly with the onset of strong diuresis. One of the patients admitted to the ships hospital exhibited an increase of all reflexes and very pronounced fatigue. The liver was painful on pressure and somewhat enlarged. There was a slight increase of protein in the urine. Special examinations could not be performed on the high seas. The joint, head and neck pain subsided only slowly. The disease is obviously due to an acute hypervitaminosis. Goethe has also pointed out that in addition to the liver of tuna fish, the liver of turbot possesses a similar action.

The eating of uncooked fish, for instance in fish salad, has led to infections with *Bothriocephalus latus*, the larva of which occurs in fish. This infection leads to severe toxic anemia. A further danger resulting from the consumption of raw fish, especially the whitfish *Leuciscus*, is the infection with the liver leech *Opisthorchis felineus*. Both of these parasites, the fish tapeworm and the liver leech, were found among German fishermen especially in East Prussia. The pathologist Askanazi saw 8 cases of liver carcinoma due to opisthorchis which he correctly interpreted as an occupational cancer of fishermen. (Opacities of the lens of the eye were produced by a trematode larva from the feces of seagulls. This disorder was due either

to the contamination of drinking water or to direct contact with the larva, which lives in the skin of fish. A similar infection well known in Japan is that due to *Metagonimus yokogawai*.)

During the years of 1924 to 1933 there occurred in East Prussia a curious disease among the eel fishers of the so-called Haff, the fresh water bay connected with the Baltic sea. This disease became internationally known as Haff disease. Approximately 1,000 fishermen became ill with severe back pain, muscle rigidity and anemia. The bloodstained urine contained myoglobin. Volatile arsenic compounds from the sewage of a Königsberg cellulose (paper) factory were at first considered responsible, later toxins from the eels. The probability of a causal relationship with arsenic received new support when in 1948 twelve patients were admitted to the Kiel University Hospital with severe irritation of the mucous membranes of the respiratory and digestive tract, some of them with unquestionable lesions of the liver and kidneys. These patients had ingested cod liver oil obtained from fishermen from the Danish island Bornholm, where a short time previously large quantities of arsenic compounds of German origin intended for chemical warfare had been dumped into the sea. That the sea is not a suitable place for poisonous munitions or atomic bombs, which may produce terrible lesions in fishermen or in the people who eat the fish, is a fact which I surely do not need to stress in Asia, where people will immediately remember the tragedy of the Japanese fishing boat "Lucky Dragon."

It is a noteworthy fact that especially among eel fishers conjunctivitis has been frequently observed, and it has been believed that a toxin from the blood serum and bile of these fish may be the cause. Approximately 150 different species of poisonous fish are known. Most of them live in tropical waters and secrete their toxins, which circulate in their blood serum, from excretory organs, stings and quills, or teeth. For these poisons wounds of the skin may be the portal of entry into the human body. Following the catch, bloody lacerations and infections of the hands may be caused by the sharp fins in the sorting, slaughtering or preparation of the fish, and the handling and cutting at the fish markets. In German seaports the

most frequent injury is that due to the stings of haddock or red perch. Of 2,000 accidents reported to the sea trade association, 241 cases were due to stab injuries caused by these stings. After return to land a lengthy treatment of these injuries was necessary.

Usually, an infection of the sting canal and surrounding tissue, in many cases an erysipeloid of the hands and forearms — often termed "fish rose" by doctors — sometimes cellulitis and phlegmonosis develop. This disorder was also seen quite often at fish markets and among housewives. Thus in Munich an extensive epidemic of erysipeloids due to the preparation of haddock occurred during the winter of 1946-1947. The cause of this infection remained unclear for a long time. Today we know that there are two pathways of infection. At the Institute for Hygiene at the University of Hamburg it was found that the mucous from the body of the fish, i.e. not only the sting, has a toxic effect on the human skin and leads to inflammation with erythema, edema and pain. This toxic action is possessed not only by the mucous of haddock, but also of rayfish. On the other hand, the veterinary school at Hannover was able to isolate a bacterium from the swollen spleen of experimental animals injured by the sting of haddock. Morphologically, culturally and serologically this bacterium was found in the fish landed during the months of May to October, not during the winter months, however. The erysipeloid bacteria were found most frequently in haddock, also in the Knurrhahn (grumbling fish), shellfish and other species. Whereas contact with the toxic mucous in sting injuries produces inflammation lasting only for a few days, the infection involving Rosenbachs bacillus seldom lasts less than 8 days. In addition to itching and fever, rheumatoids of many weeks duration may develop. Several fatal cases of fish erysipelas in man with manifestations of toxemia have occurred. On autopsy, subendocardial hemorrhages were found. Chronic diseases, one of them with a recurring erysipeloid of 9 years duration, are also on record. Specific serum therapy yielded uncertain results, penicillin is most effective. I must not withhold the fact, however, that other investigators did not succeed in finding erysipeloid bacterias. Thus Goethe, a Hamburg shipping doctor who took part in expeditions of the fishing research boat "Anton

Dohrn" of the German ministry of nutrition, only rarely saw erysipeloids, although skin inflammations with abscess formation were extremely numerous among the German fishermen sailing the waters around Iceland and Greenland; he found staphylococcus pyogenes aureus in the purulent material from the skin and subcutaneous infections. The question, whether haddock are infected with erysipeloid bacteria of staphylococci while still at sea, or whether this infection takes place in the refrigerating rooms of the fishing boats, has not yet been clarified. The source of the bacteria in the native mucous of the fish is also still a matter of controversy. For the purpose of protection against the stings, backfins and gills of the haddock, the fish are not handled with bare hands any more, but only with hooks.

Another less serious, but rather painful affection of the skin occurs in mackerel workers not only in the fish industry along the coast, but also in inland establishments. On the American and English sea coast this is known as "red feed dermatitis"; this disorder we have also seen in Germany during the months of July to September. It is characterized by an edematous erythema in the palm of the hands and flexor sides of the fingers, with hyperhidrosis. The cause is the intestinal content of mackerels (scomberoidae), with which the hands of the mackerel workers become soiled. When the mackerel cleaner firmly grasps the slippery mackerel with the left hand to slit the ventral side with a knife held in the right hand, she presses out the contents of the wide cloaca of the mackerel. During the summer months this consists of red crustaceans (copepods) which stain the intestinal contents red. This has led to the name of the disease "red feed," and must be considered as the noxious agent. At other times of the year, when the food of mackerel is derived from other sources, red feed dermatitis does not occur.

Another frequent lesion of the skin is found in the packers of salt-conserved herring. The frequency of this disease is 96 per cent. The conservation of herring in salt and the packing into barrels is carried out by hand and exclusively an occupation of women. Due to the salty brine, the fingernails break, sometimes with dissolution and partial destruction. The skin of the back of the hands, elbows and extensor sides of the

forearms swells. In packers who sometimes have to reach down deep into the barrels, the lower and middle thirds of the forearms are also afflicted. A popular name of this disease is "Salzfrass" (salt caries). Injuries due to the fins and fish-bones of herrings are frequent. As a reaction so-called "birds eyes" are formed. These consist of a sting canal with inflammation in the epidermis, sometimes also the cutis, and the formation of an elevated ridge along the upper side. Closer inspection reveals a dark hemorrhagic scab on a sharply delineated, rather deep ulcer, the edge of which, consisting of the remains of a bulla, appears slightly elevated. Some women are severely afflicted, with sometimes as many as 30 birds eyes on one arm. The packing takes place on the basis of piece work and is carried out as rapidly as possible, without regard for injury, in order to achieve a good weekly wage. The packing season begins about the middle of May and lasts until November. Occasionally deep ulcers reaching down to the ligaments and bones develop. Consequently, cicatrization and the lesions of the nails described above are the typical occupational stigmata of herring packers. The prevention of this disease is very difficult. To prevent "birds eyes" on the tips of the fingers, steel thimbles are worn, which offer only partial protection, however. In therapy, cod liver oil and sulfonamide ointment have proved effective.

Fishers also frequently suffer from so-called "salt water festering" in the form of pyoderma of the hands and wrists produced primarily by the rubbing of the creases of the oil coats against the skin and the irritative action of salt water. The condition has been called "salt boils" of the wrist.

An occupational disease observed especially in the logger fishers is tendovaginitis of the hands and arms due to overstrain. This is an occupational disease subject to compensation in Germany. The tendovaginitis or paratenonitis, resulting particularly during heavy catches with long slaughtering periods, occasionally may lead to a serious phlegmonosis of the forearms or hands with extremely hard infiltrations, severe pain and complete immobilization. A remarkable finding was that bathing in cold water alleviated the pain and improved mobility. The disease often requires weeks of conservative therapy.

After a discussion of the most important occupational lesions of fishermen, to whom we owe a considerable part of our food, I now would like to discuss the fishing industries and their occupational hazards.

The loss of the German territories in the east and the overpopulation of western Germany has seriously reduced the nutritional basis of our nation. An intensification of German agriculture was therefore inevitable. One of the decisive measures consisted in the cultivation of calorically high rootcrops. For animals, fish meal has proved to be a first rate feed, producing optimal weight increase when given in combination with 10—15 per cent rootcrops. The high demand for this type of feeding material led to the rapid development of industrial fisheries (fish processing industry) in Germany since 1951. From the end of March until the end of June, the source of fish meal is the Sandspierling (*Ammodytes lanceolatus*), an eel-like fish, 15—25 cm. in length, living at the bottom of the sea. The animals prefer sandy grounds, into which they can quickly squirm in case of danger. In 1956 the German catch amounted to 5,000 tons, in 1957 it increased to 25,000 tons. The processing yielded 6,400 tons of fish meal and 1,700 tons of fish oil valued at over six million marks. From the beginning of July until November oil herrings are caught. These are the immature 2 to 3 year old herrings (*Clupea harengus*) of high fat content, averaging 19 cm. in length. The catch of these herrings has increased greatly since 1951 and now comprises approximately 80 per cent of the total catch of small boat fishing on the high seas. Since the herrings are industrially processed, they are not eviscerated or refrigerated. The use of chemical conservatives such as formalin is prohibited by the sanitary police laws. A certain degree of putrefaction is therefore inevitable. On long fishing trips on hot summer days this may be considerable. During the summer of 1955 there was a concurrence of a very good catch and hot weather. Oil herrings which could not be processed immediately accumulated in the harbor docks and many ships had to remain before the piers because the unloading could not take place immediately. As a result of the bountiful catch many of the cutters also had a deck load of herrings, which rapidly became subject to putrefaction and disintegration. A foul stench pestered the longshoremen and inhabitants of the harbor regions. On this occasion we became acquainted

with a new occupational disease. The unloaders who had to enter the loading space of the boat to shovel the catch into the unloading machines often developed eye trouble. This illness begins with an inflammation of the conjunctivae and increases in severity to an acute painful irritation, with blepharospasm. A bilateral superficial keratitis with multiple defects of the corneal surface, often with opacities of the cornea, is found. This condition usually subsides in a few days. In persisting cases, however, "oil-herring keratitis" developed, with severe ulcerations leading to permanent opacities of the cornea, reduction of vision in some cases to the point of blindness. The number of men who became ill due to the work of unloading oil-herrings and sand eels rose to 80 per cent. In spite of the introduction of good prophylaxis and treatment, 56 per cent of the workers are still afflicted according to Ophthalmologist Prof. Friemann, Bremen. It seemed reasonable to assume that substances deriving from the herring juice were responsible. The caustic action of ammonia and lesions due to hydrogen sulfide were considered. The assumption seems more probable, that alkaloids from the animal cadavers were the cause. A parallel was seen in the fact that parenchymatous keratitis can be produced with the vegetable alkaloid colchicin. The cadaver alkaloids were studied intensively by my teacher Ludwig Brieger. They were produced under the influence of oxygen and moist warmth and are ammonia derivatives, most of them simple amines: mono-, di-, and trimethylamine. Trimethylamine has a characteristically pungent fishlike odor and also occurs as a normal product of metabolism in vaginal secretion. Even many years ago, Brieger succeeded in producing irritations of the cornea experimentally. Ratton saw painful conjunctivitis and chemosis in a cheesemaker, who handled ripe Gorgonzola and then wiped out his eye with one of his fingers. To clarify oil-herring keratitis, animal experiments were carried out by Friemann, Overhoff and Wolter. They put drops of the pressed-out juice of putrifying oil-herrings and various ptomaines into the eyes of rabbits. The effect achieved was less intensive, however, than the gases, for mono-, di-, and trimethylamine quickly evaporate in the unloading and transporting of the fish. The fact, that both eyes were always affected, also supported the conception of the action of the gaseous substances and not of chance lesions due to droplets sprayed into the eyes.

In summary, the histological examinations in experimental trimethylamine keratitis of the rabbit's eye showed severe, primarily superficial degeneration especially of the nervous, but also of the cellular elements. It seems very fortuitous that the German industrial medical specialist and ophthalmologist Friemann was able to find that cortisone ointment facilitates the recovery from the keratitis and prevents severe lesions.

This frequent illness of fishermen and unloaders of fishing boats with sand eels and oil-herrings was first studied intensively in Germany. It seems very probable, however that this disorder will also occur in other fishing regions, for instance in the Philippines. Indian ophthalmologists along the east coast near Madras, where the catch quickly deteriorates under the hot tropical sun, have already observed this illness. Not only ocular lesions have been observed. A number of unloaders in the freight space of a cutter lost consciousness on a hot day of August, 1955 and subsequently had severe circulatory disturbances. In the city of Glauchau a factory for the production of hexamethylenetetramine is located. During the manufacture of this product, trimethylamine is liberated. On a hot summer day of 1957, two workers became ill, one died of a subarachnoid hemorrhage, the other suffered a cardiac infarction with severe cerebral lesions (alternating hemiplegia, confused mental state). It has not yet been proved definitely, however, that these casualties were due to trimethylamine. I would like also to point out, that the workers in fish meal factories are also threatened by an occupational disease, for these factories employ trichloroethylene for the extraction of fat from fish meal. During this procedure trichloroethylene intoxications with loss of consciousness and narcotic states, in one case apoplexy and retrobulbar neuritis have been observed.

I hope that I have been able to show that the occupational diseases of fishermen in catching the fish, of unloaders of fishing boats and of workers employed in the processing of the fish are numerous, and that they deserve the increased attention of industrial medical specialists in cooperation with dermatologists, ophthalmologists and internists. I would be very happy, if my lecture has not tired you and if it will serve as a basis for the exchange of experience made in the Philippines and in Germany on the diseases of fishermen.