material from many abscesses scattered over the feet and body, she had ample opportunity to inoculate the soil. However, from the time of her death in July 1956 until the sample was collected on 8 October 1958, there was no known subsequent contamination of the shed with *B. dermatitidis*.

Although *B. dermatitidis* was isolated from only a single soil specimen, it has been demonstrated for the first time that this fungus can and does exist in soil under natural conditions for a long period of time. Success in isolating it when numerous attempts by others, as well as ourselves, had failed is thought to be due to the improved technique employed. It is the general opinion, with some supporting evidence, that the laboratory mouse is not especially susceptible to infection with *B. dermatitidis* when the organism is inoculated intraperitoneally. However, Heilman (*7*) found that intravenous inoculation of small numbers of both the yeastlike and mycelial forms caused death, while intraperitoneal injection of comparable doses of the same strains did not cause any symptoms in the mice. Inoculation of *B. dermatitidis* by the intravenous route allows the organisms to be carried directly to the lungs, which appear to be the most favorable site for infection to develop (*8*). Whether or not the addition of *Mycobacterium fortuitum* enhanced the isolation of *Blastomyces dermatitidis* is not clear at this time (*9*).

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Ability of Some Black Sea Organisms To Accumulate Fission Products

Abstract. The coefficients of accumulation of strontium-90, cesium-137, and cerium-144 in seaweeds, eelgrass, actinia, mollusks, and crustaceans are presented. The discharge of strontium-90 into sea water from decomposing seaweed and the retention and additional absorption of cesium-137 and cerium-144 onto organic debris is discussed. Some observations are made about the ability of these elements to diffuse into sea water and about the relative hazard to man from strontium-90 and cerium-144 in marine life.

A great deal of importance is attached to the elucidation of the role of living organisms in the general problem of the diffusion of fission products into ocean and sea waters (*1, 2*). This suggests the need for an investigation of the ability of different sea animals and plant life to accumulate the most important radioactive substances (*3, 4, 5*).

The following different marine plants and animals were selected for investigation in the present study: green algae (*Ulva rigida, Enteromorpha minor*), brown algae (*Dictyota fasciola, Padina pavonia, Cystoseira barbata*), red algae (*Corallina rubens, Ceramium rubrum, Polysiphonia elongata, Phyllophora rubens, Laurencia obtusa*), eelgrass (*Zostera marina*), coelenterata (*Actinia equina*), mollusks (*Mytilus galloprovincialis*), and crustaceans (*Pachygrapsus marmoratus, Carcinus moenas, Leander squilla*). The concentrations of Sr^{90} (in 15 species), Cs^{137} (in 7 species), and Ce^{144} (in 12 species) in these marine organisms were studied.

Specimens of the various organisms were placed in separate glass vessels filled with 2 to 5 liters of filtered sea water which contained concentrations (10μc/lit.) of Sr^{90}, Cs^{137}, and Ce^{144} (solutions of chlorides). Samples of water and organisms were collected simultaneously after 3, 6, and 12 hours and 1, 2, 4, 8, 16, 32, and 64 days had elapsed after the start of the study. One-milliliter samples of the sea water, placed in standard aluminum planchets, were evaporated under an infrared lamp. The samples of plant and animal organisms were rinsed in clear sea water, dried on filter paper, weighed immediately, and then placed in drying ovens at 80° to 90°C, after which their dried constant weight was determined. The desiccated organisms were powdered, and 10-mg paired samples of the powder were placed in standard planchets for counting. There was no self-absorption of radiation in these samples. Correction for radioactive decay was introduced for samples with Ce^{144}. The counting of Sr^{90} in the samples was done only after Sr^{90} and Y^{90} had reached equilibrium. Radiation was measured with a Geiger-Müller type counter, with a possible error of 3 percent.

The mean values of the coefficients of accumulation (the ratio of radioactivity in the organism to that of an equal weight of water) were calculated by averaging a number of coefficients, beginning with the samples of Sr^{90} collected on the second day, and with samples of Cs^{137} and Ce^{144} on the eighth day, after the experiment began. This was because from this time on (occasionally even earlier) these values were practically constant in all samples. One exception was the uninterrupted increase of Sr^{90} accumulation in the crustaceans and in the mollusk (*Mytilus*) shells. In these two, only the final values—that is, the highest coefficients of accumulation—were considered. The studies continued for as long as the organisms remained alive. The coefficients of accumulation of Sr^{90} for the crustaceans were studied through the 8th-day samples, and for the mollusk shells through the 64th day. The coefficients for Cs^{137} and Ce^{144} in the crustaceans and the mollusk shells were calculated through the 16th-day samples.

The coefficients of accumulated values for Sr^{90}, Cs^{137}, and Ce^{144} for certain species of marine organisms are shown in Table 1. The data for the coefficients of accumulation of Sr^{90} in

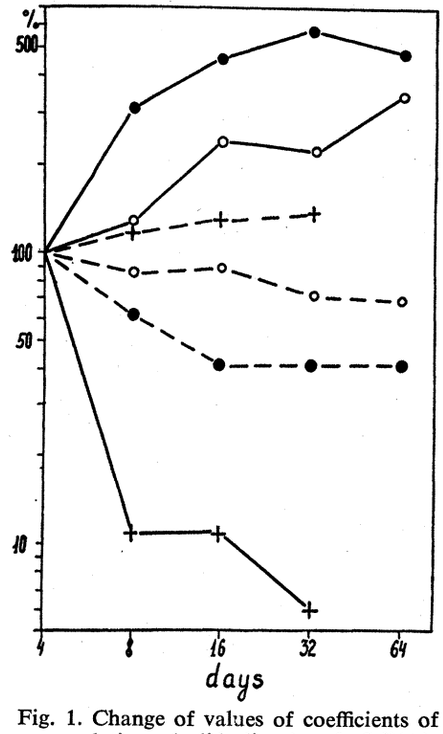

Fig. 1. Change of values of coefficients of accumulation (solid lines) of Sr^{90}(+), Cs^{137}(○), and Ce^{144}(●) in the process of dying off of *Cystoseira*. Concentration of activity in sea water is shown by dashed lines. The times are from the beginning of the experiment. Dying began after 4 days in the absence of fresh sea water.

Table 1. Coefficients of accumulation of Sr^{90}, Cs^{137}, and Ce^{144} in some marine organisms.

Specimen	Coefficients of accumulation					
	Living weight			Dried weight		
	Sr^{90}	Cs^{137}	Ce^{144}	Sr^{90}	Cs^{137}	Ce^{144}
Green and red algae	1–6	4–10	300–900	10–30	40–50	2600–4500
Brown algae	20–40	30	340	150–280	200	2500
Zostera	3	2	180	30	20	1800
Actinia	1	10	165	9	60	1500
Mytilus						
Soft body	0.7	10	360	4	80	2600
Shells	6	0	43	6	0	43
Total	6	3	33	6	20	60
Crustacea	3–8	10	230	10–35	30	670

algae and mollusks of the Black Sea are in agreement with the results of similar studies on algae in the Atlantic Ocean (*3*) and oysters in the Pacific (*4*).

After the death of the organism, and in the process of decomposition of the algae *Cystoseira barbata,* the accumulated Sr^{90} returns to the sea water (Fig. 1), and the values of the coefficients of accumulation fall, approximating unity. The same is true for other brown algae. The coefficients of accumulation for Sr^{90} in green and red algae do not change at the time of the death of these organisms, but remain near unity. Cesium-137 and Ce^{144} not only remain in the amount which had been absorbed during the life of the organisms, but are absorbed in additional quantities from the solution onto the remaining debris (Fig. 1).

If we designate the coefficients of accumulation for Ce^{144} as K_{Ce} and for Sr^{90} as K_{Sr}, and the maximum permissible concentration in water for man (*6*) for Ce^{144} as C_{Ce} and for Sr^{90} as C_{Sr}, then $K = K_{Ce}/K_{Sr}$. K will be in the order of 10 to 100; and $C = C_{Ce}/C_{Sr}$ will be in the order of 10,000; hence C/K gives values in the order of 100 to 1000. In other words, despite the low coefficients of accumulation of Sr^{90} in marine organisms which are used as food, Sr^{90} is more dangerous to man (about 100 to 1000 times) than Ce^{144}, which has high coefficients of accumulation, when both are present in the same concentration in sea water. The same is apparently true for all other mammals which feed on sea organisms.

High coefficients of accumulation of Ce^{144} in living organisms and in their organic remains indicate it is less mobile than Sr^{90} with its low coefficient of accumulation in mass bottom organisms and its ability to return into the seawater (when the coefficients of accumulation are greater than 1). Cesium-137 occupies an intermediate position. However, there is a possibility of Ce^{144} being retained in the upper layers of the ocean by plankton (*7*). Strontium-90 is a constant source of Y^{90}, which has high coefficients of accumulation in marine organisms (*5*). By using the concept of zones of accumulation of radioactivity in water reservoirs (*8*), it is possible to classify Sr^{90}, in contrast to Ce^{144}, in the group of elements not forming a distinct zone of polyaccumulation. Obviously it is necessary to take into consideration these characteristics of Sr^{90}, and also the most recent oceanographic information (*1, 9, 10*), when one is discussing problems of disposal of highly radioactive wastes of the nuclear industry into the depths of the sea, and the Black Sea in particular. According to the latest data (*10*), the time interval for the rise of bottom waters to the surface in the Black Sea is from 60 to 130 years. In the course of this time period Sr^{90} radioactivity would diminish 5 to 30 times.

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Editor's note: Translation from the Russian was done at our request by Mrs. R. G. Ernsberger of the translating unit of the National Institutes of Health, Bethesda, Md. The English version was approved by the author.

Slowing of Heart Rate after Septal Self-Stimulation in Rats

Abstract. Heart rate, recorded continuously from rats trained to press a bar for intracranial electrical stimulation of their septal areas, fell consistently after brain stimulation. Interpretation of the rewarding effect of septal stimulation had previously been limited by the absence of any data on the autonomic effects of the stimulation. The results of this study suggest that the rewarding effect may possibly be produced by a parasympathetic (quieting) reaction of the autonomic nervous system to septal stimulation.

Heart-rate recording was chosen as a first step in the physiological investigation of intracranial self-stimulation (i) because of the clear way in which it reflects the balance between sympathetic and parasympathetic influences, (ii) because a method for recording the heart rate of the free-roving rat was available, and (iii) because Hess's previous studies of septal stimulation in the cat had revealed slowing of the heart rate (*1*).

Electrodes were implanted in the brains of seven 225-g male hooded rats by the method previously described by Olds and Milner (*2*). Michel wound clips with soldered bus-wire attachments were used as electrocardiograph electrodes. A recovery period of at least 3 days was allowed after operation before we started the two habituation sessions and the five subsequent 20-minute experimental sessions in the testing apparatus (Skinner box), all on consecutive days. The testing apparatus was similar to that previously described (*2*). A lever placed near the floor of the box actuated a microswitch in the stimulating circuit, so that by pressing it the rat received electrical stimulation delivered by a Grass model S4 stimulator set for biphasic electrical stimulation with a duration of 0.5 msec and a frequency of 100 cy/sec. Voltage (peak-to-peak) was set initially at 1.5 volts and was advanced as required, usually to 5 to 7 volts. A Hunter timer was used in the circuit to cut the current off after a period of 0.5 second if the rat continued to hold the lever down. In the initial stage when the experimenter was teaching the animal to self-stimulate, the experimenter stimulated the animal by activating the bar-depression mechanism from outside the test box. In the latter half of the fifth experimental session the current was turned off so that when the animal pressed the bar there was no electrical stimulation; this was the extinction procedure.

During experimental sessions, continuous tracings of electrocardiograms and bar-presses were taken on a Grass model 5A Polygraph, Microdot "Mininoise" triaxial cable (No. 50-3928)