Letters

Digestive Tract of the Oyster

According to an item in *Science* [**135**, 360 (2 Feb. 1962)], the Food and Drug Administration refused to certify whole fish flour because the viscera were included in its manufacture. If the product is chemically and bacteriologically clean, it is clean, but I do not wish to join the controversy.

However, one statement startled me: "[Commissioner George P.] Larrick agreed that a number of whole-fish products—sardines, shrimp, oysters, and clams—have FDA approval, but he noted that these had gained consumer acceptance before FDA was established." Apparently Larrick believes that the intestine of an oyster contains putrid fecal material. That concept is erroneous. A raw oyster from an unpolluted bed is as clean as a cabbage growing in a field. Up until a few years ago one could order "dressed" oysters at some hotels, which had the green digestive gland removed because of the mistaken idea that it was feces. This gland is sometimes called the hepatopancreas, although its functions are somewhat different, and it is one of the more nourishing and better parts of the oyster.

The digestive tract of an oyster is ciliated. Diatoms often go through the whole system alive and are deposited with the little pellets of sand, silt, diatom shells, and mucus, which are called feces. Decay does not take place in the oyster's short intestine, and the ejected material is not comparable to mammalian feces, which are largely products of bacterial decay. In fact, it is indistinguishable in gross characteristics from material rejected before it reaches the oyster's mouth and cast off into another little pile.

In small Virginia oysters growing on glass slides the lower valve is transparent until the oyster is several millimeters long, and its internal workings can be viewed under the compound microscope. I have watched balls of food formed by the labial palps go into the mouth and traverse the whole digestive tract of these small oysters in less than a minute. R. W. Menzel [*Univ. Texas Inst. Marine Sci. Publs.* **4**, 123 (1955)] has shown that oysters 12 millimeters long passed carmine particles 6 minutes, and stained plankton 10 minutes, after ingestion. Food particles go through the digestive tract of oysters much too fast for bacterial decay to take place.

There is an injustice concerning the use of American oysters which deserves comment. Oysters from foreign countries coming originally from polluted beds are imported and pass Food and Drug Administration standards, as they should, because they are sterilized in the canning process. On the other hand, oysters from polluted beds in this country cannot be used for canning, and hundreds of acres of oyster beds are unused every year because domestic canners are not permitted to produce clean products under the same conditions that foreign canners are.

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The Basic Variable in the Early Handling Phenomenon

I wish to direct attention to some logical and procedural difficulties contained in the recent report by Schaefer *et al.* (*1*). The authors hypothesize that "the effects of early handling are due to lowered skin or body temperature." The hypothesis was tested by handling one group of rats ("handled" group), placing the litters of another group in a refrigerator set at 7° to 10°C ("cold-exposed" group), placing the litters of a third group in a nonfunctioning refrigerator maintained at room temperature (23°C) ("cold-control" group), and not manipulating a fourth group ("nonhandled" group). These treatments were continued daily throughout the first week of life. At 12 days of age half the pups from each group were subjected to stress by being placed in a refrigerator at 55°C for 90 minutes. After this they were sacrificed, and the ascorbic acid content of the adrenals was determined. The ascorbic acid content of the adrenals was determined for the remaining animals without their undergoing the "cold stress."

Measurement of the levels of adrenal ascorbic acid in four differentially manipulated groups under two conditions ("cold stress" and "nonstress") involves a 4×2 factorial analysis. The only analysis made, however, was a test of the difference in findings for "stressed" and "nonstressed" animals *within* a given group. The adrenal ascorbic acid content of the cold-stressed handled animals was significantly lower than that of the nonstressed handled animals, and animals previously subjected to cold had a significantly lower level of adrenal ascorbic acid after cold stress than the similarly manipulated nonstressed animals. There were no differences in findings for the stressed and the nonstressed animals of the nonhandled or cold-control groups.

On the basis of this analysis the authors state, "These results indicate that the essential aspect of the handling procedure is a drop in environmental temperature accompanying removal from the nest." Further, it is stated, "Subjecting the pups to low temperature on days 2 through 7, although they were somewhat insulated in the nest by the mother, produced the same effect as handling (which exposed pups to room temperature for the same amount of time)."

That the effects of handling and exposure to cold are the same (or different) was, technically speaking, not tested in this experiment. Clearly, there is a significant *depletion* of adrenal ascorbic acid in response to cold stress in both handled and cold-exposed groups; however, there was no reported test of the possible difference between the depletion scores of handled and of cold-exposed groups.

Figure 1 of the report suggests that there was no significant difference between the *depletion* scores of handled and of cold-exposed animals. The significance of the difference in the scores for the cold-exposed and the cold-control groups cannot be determined from the figure. If the difference for these groups is significant, then it is likely that results for the cold-control group also differ significantly from those for the nonhandled animals, since the