

Two of these Benoît standards gave different results at different times. For instance, one whose resistance had been designated as 1.00045 legal ohms by Benoît, showed, when first filled, the same resistance in terms of the Cambridge standards; the next day its resistance was found to be 1.00071, and, on flowing the mercury back and forth through it, it rose to 1.00080. The tube was examined, but no trace of an air bubble was seen. It was then cleaned and filled again, and afterwards gave consistent results, the mean being .99990 legal ohms, though the same precautions were taken in the first filling as in the last. This result indicates the uncertainty of mercury standards, and the extreme care that is required to obtain consistent results. Every mercury standard should be made of such a form that the tube can not only be washed, but wiped out by some mechanical means. It is important to notice that the rate at which the resistance of mercury varies with the temperature has been examined lately by Mr. Glazebrook, and he finds that the rate of change diminishes rapidly as we approach 0°; the average change between 0° and 5° being .000834, while between 0° and 15° it is .000879.

CHOLERA PROSPECTS FOR ENGLAND.

IN regard to the prospect of the cholera reaching England this season, the *Lancet* of Oct. 24 says: We have now reached a period when we may fairly form a judgment as to the more immediate cholera prospects for England. Although cholera in Europe usually follows certain definite rules as to climate and season, yet it deviates from these sufficiently often to impart an element of uncertainty to any opinion concerning its movements. But notwithstanding this, the chances of any extension of the present epidemic to this country are now so remote that we may fairly conclude that we have for a third year escaped from the danger with which we have been threatened. It is true that in 1884 our greatest danger did not arrive until Paris had become infected, and that this did not take place until we were well into the first week of November; but, on the other hand, the extent and the area of diffusion of cholera in France was last year far greater than it has been this year, and cholera deaths occurred in 1884, both at Toulon and Marseilles, until about the end of November. This year, on the contrary, France has practically been free from cholera for some time, and the main risk we have to contend with lies in our shipping relations with Spain and Sicily, and these are limited both in amount and in the number of home ports concerned. So, also, we have had evidence that the vigilance and activity

which have been exercised by our port authorities with regard to any such importations have been successful, even when, in a few occasional instances, there was reason to believe that isolated cases of the disease had found their way to our shores. And, further, the danger from places in the south of Europe, which are still infected, is every week becoming less by reason of a general subsidence of the epidemic. On the whole, therefore, we may with a considerable degree of confidence conclude that we have another season before us during which we may, unhindered by any element of panic, go on maturing our preparations to withstand such danger of cholera importation as may recur next year; and we have the satisfaction of knowing that the preparations needed are precisely those which will tend to diminish mortality from other causes than cholera, and that the needed expenditure will in the end tend to our prosperity.

ARTIFICIAL PROPAGATION AND CULTIVATION OF OYSTERS IN FLOATS.¹

WITHOUT expressing any opinion as to the value of the process of 'fattening' oysters by placing them for a few days in cars floating in fresh water, I wish to point out that there is no similarity between this process and the process of propagation which is here described.

My attention was first called to the value of floating cars in oyster culture by Mr. William Armstrong of Hampton, Virginia, who informed me in 1884 that 'seed' oysters, which he had placed in floating cars in the mouth of Hampton Creek, grew more rapidly, and were of a better shape and more marketable, than those which grew from seed planted on the bottom in the usual way.

One of the results of my study in 1879, of the development of the oyster, was the discovery that there is a period of several hours, immediately after the embryo acquires its locomotor cilia, when it swims at the surface, and this is the period when it is swept into contact with collectors. As soon as the shell appears, the larva is dragged down by its weight, and either settles to the bottom and dies, or swims for a time near the bottom. The tendency to swim at the surface is an adaptation for securing wide distribution by means of the winds and currents which sweep the young oysters against solid bodies which may serve for attachment; and the greatest danger to which the oyster is exposed, at any part of its life, is that it may not, at the swimming stage, find a clean, hard surface for attachment.

¹ From *Johns Hopkins university circulars*, October.

As it is microscopic and only about half as thick as a sheet of thin paper, it may be smothered by a deposit of sediment or mud so light as to be invisible; and most of the failures to get a good 'set of spat' are due to the formation of a coat of sediment upon the collectors before the young oysters come into contact with them.

It occurred to me this summer that this danger could be entirely avoided by the use of floating collectors; for little sediment can fall on a body which is close to the surface of the water, and most of this will be swept away by currents, which will, at the same time, sweep the swimming embryos down into the collector, and thus insure an early, abundant, and successful 'set.'

I accordingly constructed a floating car, made so as to permit the free circulation of the water. This was filled with clean oyster-shells, and moored in the channel in front of the laboratory at Beaufort, N. C., on July 4. As all the oysters in the vicinity were in very shallow water, they were nearly through spawning, and the conditions were therefore very unfavorable; but, notwithstanding this, I immediately secured a good 'set,' and the young oysters grew with remarkable rapidity, on account of the abundant supply of food and fresh water which gained ready access to all of them, and the uniform temperature which was secured by the constant change of water.

This method of oyster culture may be applied in many ways, of which the most obvious is the production of seed oysters for planting.

The 'seed' which is used for planting in Maryland and Virginia, as well as in Delaware and farther north, is now procured from the natural beds of our waters by tonging or dredging, and as the demand for oysters for this purpose is certainly one of the elements which have led to the depletion of our beds, there is a wide-spread feeling that the exportation of 'seed' should be prohibited.

By a small investment of capital in floating collectors, any one on tide-water could easily raise large quantities of much better, cleaner seed than that which is now procured from the natural beds; and, if the laws permitted the sale and transportation of this seed without restriction at the season when the demand exists, it could be sold at a profit for less than the cost of tonging.

Northern planters could also raise seed for themselves by constructing floating collectors in the warm water of the sounds of Virginia and North Carolina, where the length of the summer would permit several collections to be made in one season. The oysters thus reared are large enough for planting in five or six weeks, and in the latitude

of Beaufort there is an abundance of spat from the middle of April to the first of July, and it can be collected until September.

The method may also be used by planters for collecting their own seed, especially in regions remote from a natural supply. If there are no oysters near to furnish the eggs, a few spawning oysters may be placed among the shells in the collector, after the French method, to supply the 'set.'

It can also be used for the direct production of marketable oysters, especially over muddy bottoms, and in regions where public sentiment does not permit any private ownership of the bottom.

As food for the oyster is most abundant at the mouths of muddy creeks, where the bottom is too soft for oyster culture by planting or by shelling, this method will have especial advantage in such places; for there will be no danger of sanding or of smothering by mud at the surface, and there is no limit to the number of oysters which can thus be grown on a given area, for the free current of water will bring food to all of them.

The very rapid growth will more than compensate for the cost of the floats, and Mr. Armstrong's experiment shows that, in addition to all these advantages, the oysters are of a better shape, with better shells, and more marketable, than those grown at the same place on the bottom.

Finally, this method will do away with the necessity for a title to the bottom, and will thus enable a few enterprising men to set the example of oyster culture, and, by the education of the community, to hasten the time when wiser laws will render our natural advantages available for the benefit of our people.

The most economical method of constructing floats must, of course, be determined by practical experiments; but a float constructed by connecting two old ship-masts together by string pieces, with a bottom of coarse galvanized iron netting, would have sufficient buoyancy, and enough resistance to water, to support a large quantity of submerged shells and oysters for two or more seasons, and a coating of copper paint each year would protect the timbers from worms.

The floats should be open at the ends to permit free circulation, and they should be moored in such a way as to swing with the current.

Engagement in business projects is no part of the office of a university, and I feel that the experiments of the past summer have brought the subject of oyster culture to a point where its further development should be left to the people who are most interested.

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