DR. ASA GRAY'S SEVENTY-FIFTH BIRTHDAY.

THE seventy-fifth anniversary of the birth of Dr. Asa Gray occurred on the 18th of November. At the suggestion of the editors of the *Botanical gazette*, many of the botanists of North America united in presenting to the foremost botanist of the country a token of love and esteem in the form of a silver vase.

This vase was presented on the morning of the 18th, without formality. It is about eleven inches high, and is appropriately decorated with those plants which are distinctively American, and which are most closely associated with Dr. Gray. The place of honor on one side is held by Grayia polygaloides, and on the other by Shortia galacifolia. Among others, Aster Bigelovii, Solidago serotina, Lilium Grayi, Centaurea Americana, Notholaena Grayi, and Rudbeckia speciosa, are prominent. The workmanship is highly artistic, as well as remarkably accurate, and reflects credit upon the designers, Messrs. Bigelow, Kennard, & Co., of Boston.

The vase stands on a low ebony pedestal, which is surrounded by a silver hoop, bearing the inscription, —

1810 — November eighteenth — 1885.
ASA GRAY,
in token of the universal esteem
of American botanists.

The greetings, by card and letter, of the one hundred and eighty contributors, were presented on a plain but elegant silver tray. They contain the warmest expressions of esteem and gratitude.

In the afternoon Dr. and Mrs. Gray received, quite informally, many of their friends.

A NEW SYSTEM OF OYSTER-CULTURE.

THE hope that I might solve, or help to solve, the oyster-problem practically, has served to constantly encourage me for the five years that I have been working with that object in view. In the belief that what I now have to offer presents one of the only possible practical solutions of the oyster-question, I submit it to the oystermen of our country as a method by the help of which they may be enabled to rear an abundance of 'seed' upon areas which are positively and absolutely under individual, proprietary control. The first principles of the new method are given below, and it will be seen that they include or embrace all that it has been proposed to accomplish by the use of any other plans hitherto proposed; that is, it is proposed to utilize the three dimensions of a body of water, moved automatically back and forth in a canal by the tides, for the purpose of spat-collecting. In such a canal an enormous amount of cultch or collecting surface will be exposed to the fry, diffused throughout the three dimensions of the surrounding water, during the spawning season. In this way the maximum amount of spat can be obtained with a minimum expanse of water.

The first principles of the new method of spat or 'seed-culture,' which I here propose, are the following: —

1. Oyster embryos diffuse themselves throughout the three dimensions of a body of water, and will affix themselves to collecting surfaces similarly distributed, up to and even above low-water level.

2. The floating fry will adhere to smooth surfaces as well as rough ones.

3. The surfaces upon which spatting occurs must be kept as free as possible from sediment and organic growths, in order that the very tiny young

mollusks may not be smothered and killed during the most critical period of their lives.

4. Artificial fertilization of the eggs of the oyster is feasible, and will become an important adjunct to successful spat-culture.

5. The water charged with embryo oysters may be passed through a steam-pump without injury.

6. Oyster fry usually adheres most freely to the under surfaces of shells or other collectors, because the lower side is cleanest, and most favorable to the survival of the animals.

7. The spat of the oyster will grow and thrive with comparatively little light.

8. The specific gravity of the water may range from 1.003 to 1.0235.

9. The most favorable temperatures of the water for spatting seem to be from 68° to about 78° to 80° F.

10. Spatting will occur just as freely in ponds or tanks with a free circulation as in open water.

These are the elementary principles upon which we must base our new method. All have been verified by observation, and none of them are hypothetical; but to give an account of all the data upon which they are based would take up too much space here. The methods of spat-collecting used in Europe are too cumbersome and expensive; besides, they are inefficient when applied to the American oyster, largely because of its low price. The thing to do is to arrange the collectors in such a way as to expose an enormous area of surface to which the billions of fry, swimming about in the water, may become adherent. To effect this it is proposed to provide a pond, natural or artificial, and connect it by way of a long, zigzag canal with the open water. The area of the pond, for a good reason, should be about the same as that of the canal. The canal and pond should be of about the same depth, or contain about three and a half feet of water at low tide. No filters are needed, except, perhaps, a screen at the mouth of the canal to keep out starfishes, large crustacea, and predaceous gastropod mollusks.

The canal is provided with ledges near the top, at about the level of low-water mark, to support the receptacles for the cultch. These are formed of vertical wooden strips six inches wide, six feet long, and secured parallel to each other, and three feet apart, by a cross-piece at the top, and two horizontal side-pieces six inches wide, secured two feet six inches from the top of the vertical pieces. Coarse galvanized wire netting is then secured around the edges and lower ends of the vertical strips below the two parallel cross-pieces. This netting will then form, with the wooden frame, a basket three feet wide, three feet deep, and six inches thick. Such a basket will hold somewhat over three bushels of oyster-shells as cultch. The two cross-pieces which project beyond the vertical pieces will support the receptacle, with the shells which it contains. One of these receptacles is allowed to every running foot of canal, in which its position is vertical. The receptacles are therefore placed six inches apart. A pond forty feet square, and accommodating 100 bushels of spawning oysters, on two superimposed platforms, will supply enough fry for a canal 400 feet long, and holding 1,200 bushels of shells as cultch in 400 receptacles. The latter will cost, at the lowest rate for material and labor, $50 per hundred, or $200 for 400 feet of canal. One bushel of oysters will yield about one billion of eggs and fry. The pond, with its hundred bushels of spawning adults, will therefore yield about 100 billions of fry. This vast multitude of oyster-brood will be wafted back and forth through the collectors by the tides 360 times during the spatting season, which lasts for ninety days. That is, 100 billions of fry will be wafted through 1,200 bushels of shells 360 times during the season, thus insuring the fixation of the largest possible percentage of embryos. The shells can be kept clean by vibrating the receptacles on the ledges which support them. It will thus be seen that on one-tenth of an acre I can place as much cultch as could ordinarily be placed on four acres. Or, by my method, on one acre I can put down as many shells as could be put on forty acres by those who simply sow the shells; that is to say, the business of getting 'sets' for planting in the open water may be so condensed as to cover only one-fortieth of the ground now covered. After the lapse of ninety days, the cultch, with its adherent spat, is removed from the collectors, and sown in the open water. The method is therefore solely for the purpose of propagating the oyster, and commends itself as the most feasible in the Chesapeake region, where it is hoped that private enterprise will establish nurseries where seed-oysters alone will be cultivated, to supply the demand for planting new beds. Thousands of acres of the flat, marshy land skirting the Chesapeake and Chincoteage bays are available, and may now be converted into establishments for the culture of oyster-spat.

The plans set forth above are justified in detail by the facts observed by myself in the course of the experiments instituted by me during the last five years, under the auspices of the U. S. fish commission. In nature the theory is also abundantly verified, as, for example, at Wood's Holl, Cohasset, and Fortress Monroe. The fullest justification of the conclusions above presented is also given by the results obtained at Cherrystone in 1881, and at

St. Jerome's Creek from 1880 to 1885; while the most conclusive and irrefragable evidence is that obtained as the results of experiments instituted by Professor Brooks and Messrs. Blackford and Mather during the present year.

The maximum efficiency of the cultch is not realized in any of the old forms of collectors, for the reason that the cultch cannot be kept clean; second, because both sides of the cultch cannot be exposed to the passing fry; third, because the fry cannot be forced to pass over and amongst the cultch repeatedly; fourth, because the cultch has hitherto been scattered over too great an area, and throughout only two dimensions of a body of water, namely, its horizontal extent, whereas it is possible to do far more; that is, to avail ourselves of the possibility of obtaining spat throughout the three dimensions of a body of water charged with embryo oysters in the veliger condition. These are good and sufficient reasons for my assertion that cultch has hitherto been wastefully and unscientifically applied.

The new method outlined above will be explained in detail, with plans drawn to scale, in an extended illustrated article of mine now ready for publication by the U. S. fish commission. In fact, as a result of scientific inquiry, it has come about that there may be applied a more effectual means of diminishing the mortality and frightful waste of oyster embryos, which occur under the stress of those natural conditions which determine the 'struggle for existence.' This result was predicted at the close of a lecture delivered in 1883 by Professor Huxley, in these words: "I, for my part, believe that the only hope for the oyster-consumer lies first in oyster-culture, and, second, in discovering a means of breeding oysters under such conditions that the spat shall be safely deposited. And I have no doubt that when those who undertake the business are provided with a proper knowledge of the conditions under which they have to work, both these objects will be attained."

JOHN A. RYDER.

PASTEUR AND HYDROPHOBIA.

PASTEUR'S communication upon the treatment of hydrophobia by inoculation, to which reference was made in a recent number of *Science* (Nov. 6), is fully and authoritatively reported in the *Comptes rendus* of Oct. 26. His present results are based upon a series of experiments upon rabbits and dogs, extending over a period of three years. So numerous have been these experiments, and so uniform and certain their results, that he has no hesitation in applying these results to other animals, including man.

Pasteur finds, that if a rabbit be inoculated by trepanning the skull, and placing beneath the dura mater a bit of spinal cord from a dog which has died of rabies of the streets (*rage des rues*), the animal always develops hydrophobia after a period of incubation of about fifteen days. If from the spinal cord of this first rabbit a second be inoculated in a similar way, and from the second rabbit a third, and so on in regular series, it is found that the period of incubation becomes shorter and shorter, until, after the virus has thus passed through forty to fifty rabbits, the duration of incubation is reduced to seven days. The incubation has remained at this point for a series of ninety inoculations, and it shows no tendency further to decrease. The virus has now reached its highest degree of intensity, and it remains of a constant quality. It is possible, therefore, to have such a pure virus of rabies at all times at disposal.

If portions of the spinal cord of rabbits which have died of this intense rabies be cut out with every precaution to prevent contamination, and if these portions of cord be suspended in a dry atmosphere, the virulence of the poison progressively disappears until it is completely extinguished. The time required for the extinction of the virus varies somewhat with the thickness of the cord, but especially with the temperature. The lower the external temperature, the longer the virus lasts. To preserve the cords, Pasteur places them in flasks, in which the air is rendered dry by bits of potash in the bottom of the flasks. It is possible, therefore, to have the virus of rabies in all degrees of intensity.

In order to render a dog refractory to hydrophobia, it is necessary to inoculate him with a series of spinal cords from rabbits dead of rabies, beginning with cords containing the weakest virus, that is, the cords longest preserved, and ending with cords containing the most intense virus, that is, cords preserved only one or two days. The animals are inoculated every day with cords representing successively each day or each two days of preservation. The inoculation is effected by injecting beneath the skin a Pravaz syringeful of sterilized bouillon in which a fragment of the spinal cord has been rubbed up. In this way complete immunity to the disease is established; so that, after the treatment is finished, the animal can be inoculated either subcutaneously or beneath the dura mater, with the most intense rabid virus, and no symptoms of hydrophobia appear. Pasteur has fifty dogs, of all ages and of all races, which in this way, without a single failure, he has rendered refractory to hydrophobia. The treatment is effectual even if it be applied after the dog has been