Sex-change in the Native Oyster (O. edulis).

IT is well known that sex-change in the native oyster (*O. edulis*) occurs at some period of its life. This mollusc apparently always begins life as a male, and may change into a female at the age of one or two years. Very little is, however, known about the change of sex afterwards. In following up the indications given from a general study of breeding (see J. H. Orton, "Sea-temperature, Breeding, and Distribution in Marine Animals," Journal of the Marine Biological Association, vol. xii., July, 1920, pp. 339–66), it seemed certain that an oyster ought to continue breeding in the same season even after becoming white-sick, *i.e.* after extrusion of ova into the mantle cavity. Thus if a breeding oyster were marked and examined afterwards, it should be possible to find out something about a possible *annual* change of sex. Accordingly on July 30, 1920, two white-sick oysters were isolated in a tank at Plymouth, and one of them was cut open and examined on August 26, 1920. At the latter date the one examined [1] was found to have its gonad full of wholly ripe sperm-morulæ, which disintegrated into separate active and apparently ripe sperm as soon as they were placed in sea-water. Thus a female-functioning oyster had changed into a male-functioning oyster within less than a month. An indication of this change had already been given on July 29, when the gonad of a white-sick oyster—examined at the moment when it contained embryos in the mantle cavity—showed developing sperm-morulæ and some actively tailed sperm-morulæ.

The occurrence of developing sperm-morulæ in microscopic sections of "white-sick" or "black-sick" oysters has, indeed, been already observed by P. P. C. Hoek in a practically unknown and very valuable piece of work on the oyster ("Rapport over de Oorzaken van den achteruitgang in hoedanigheid van de Zeeuwsche oester," p. 175. Uitgegenen Door Het Ministerie van Waterstaat, Handel en Nijverheid, 's Gravenhage).

This year the observations on "white-sick" oysters have been repeated, and all the oysters examined have shown either some sperm-morulæ with active tails which disintegrate into separate sperm in sea-water, or developing sperm-morulæ. It is seen, therefore, that even at the time an oyster is carrying its own embryos it is changing into a male-functioning form, which will apparently function as a male within a very short time.

An endeavour is being made this summer to carry out on a larger scale the isolation in the sea of oysters of known sex at a particular moment with the view of determining the sex at a later date. It is hoped in this way to investigate also the possible change of an oyster which is male-functioning at the beginning of the breeding season into a female-functioning form at a later period in the same season.

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[1] The other specimen kept for examination this year died at the end of May.

A New Acoustical Phenomenon.

I HAVE read Dr. Erskine Murray's letter in NATURE of June 16, p. 490, with very great interest, but I think there are two difficulties in the explanation that he has there advanced:—

(1) It is hard to see how or why an aeroplane should emit a series of pairs of double sound impulses; and (2) even if they were emitted, the ear would find it difficult to observe any change in pitch as the distance from the ground was varied; for it is found by experiment that pairs of sound impulses cause a sensation of pitch which is sufficient for the identification of a note as being high or low, but is too indefinite for the appreciation of small differences of wave-length.

I should like to suggest instead that the phenomena observed by Dr. Erskine Murray are due to the presence of a series of stationary sound-waves of various wave-lengths lying parallel to the ground, analogous to the stationary waves of light employed in Lippmann's colour photography. These stationary sound-waves would be produced by reflection at the surface of the ground, the nodes occurring at a distance from the ground inversely proportional to the pitch.

This suggestion fits in with the observed facts (1) that the note heard varies inversely as the height of the observer's ear from the ground; (2) that the effects are best observed when the aeroplane is nearly overhead; (3) that the note heard at a given height varies with the angle of elevation of the aeroplane; and (4) that the surface of the ground must be smooth.

As to the source of these series of notes of different wave-length, it would seem that the turbulent air behind wings, framework, and propeller must be responsible, and the fact that wind passing through a tree can create similar phenomena would seem to confirm this view. With regard to the physiological aspect, it has long been known that double sound impulses do give a crude sensation of pitch, and both theories of hearing have offered suggestions to account for it.

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DURING the war and since I have often noticed how the apparent pitch of aeroplane noise changes suddenly as an aeroplane travels over the street in which one is standing. I had put this down to reflection, but not on the lines followed by Dr. Erskine Murray in his letter in NATURE of June 16, p. 490. As the problem is of practical importance to such bodies as the War Office and Admiralty, in, for example, recognising aircraft at night or in fogs, it seems worthy of discussion.

If the sound from an aeroplane were a pure tone no amount of reflection could give the sensation of the octave, for two harmonics of equal period combine into an harmonic of the same period. If the sound is impure and has overtones, combination of direct and reflected waves could have the effect only of altering the quality by suppressing some components and reinforcing others. I suggest that Dr. Murray heard the upper tones because of interference between the direct and reflected waves of the lower. That the noise from an aeroplane, though often of musical quality, is not a pure tone is clear. Exhaust noise, in spite of the approximately harmonic motion of the pistons and valves, is not a pure tone. Complications arise from the explosive emission of the gases. Moreover, in addition to the dominant exhaust noise, there are secondary noises from propeller, fuselage, etc.

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15 Bolton Road, Chiswick, W.4, June 20.

THE acoustical phenomenon described by Dr. Erskine Murray in NATURE of June 16, p. 490, is fully discussed by F. A. Schulze in a paper which appeared in the *Annalen der Physik* in 1916 (vol. xlix., p. 683). References to earlier work on the subject are