20.0° C. or higher (Townsend, Stafford, Churchill, Prytherch and others).[2, 3, 4, 5] These field observations were confirmed in the laboratory by Galtsoff,[6, 7] who stated that the results of his extensive experiments with *O. virginica* showed that no spawning occurred below 20.0° C. However, the writer's observations of the last two summers on the spawning of oysters in Long Island Sound indicate that spawning may take place at temperatures several degrees lower than the so-called critical temperature of 20.0° C. In 1937 the initial and general spawning of the oyster population of the Sound, living in water from 1 to 25 feet, took place on and about July 3. The date of spawning was ascertained by Mr. James Engle and the writer by the age of oyster larvae found in the water, by the time of the beginning of oyster setting and, chiefly, by gross and histological studies of oyster gonads. The last method provided infallible proof that the gonads of oysters were partly discharged. The bottom water temperature several days prior to and during spawning time ranged from 17.5 to 18.5° C.

In 1938 the first spawning of oysters occurred on June 28, far ahead of the expected time. At one of our stations located in 30 feet of water, half of the oysters examined were found with partly discharged gonads, although the highest bottom temperature recorded at that station prior to and at the beginning of spawning was only 16.4° C. The highest temperature recorded at any of our 15 sampling stations, distributed over a distance of 30 miles of the oyster-producing section of the Sound, was 18.3° C. The average bottom water temperature of all 15 stations was 17.0° C. To avoid any errors in recording, the water temperature measurements were taken simultaneously with four deep-sea reversing thermometers, their correctness verified by the U. S. Bureau of Standards. The temperature was read by two investigators. At the invitation of the writer, Dr. P. S. Galtsoff, of the U. S. Bureau of Fisheries, was present on the investigation trip on June 30 and confirmed the fact that oysters spawned at temperatures lower than 20.0° C.

The observations of the last two summers refute the method advanced by Prytherch[8] for predicting one month in advance the time of spawning. His method is based upon the assumption that the spawning of oysters can not occur at a temperature lower than 20.0° C. Evidently, some other factors, undetermined at present, are involved in inducing the spawning of oysters at low temperatures. Until these factors and their role in stimulating the shedding of sex cells can be ascertained, no infallible method for predicting the time of spawning of oysters living under natural conditions can be advanced.

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2 C. H. Townsend, Rept. U. S. Fish. Comm. for 1889–91, 345–348.
3 J. Stafford, Comm. of Conservation, Canada, 1–159, 1913.
4 E. P. Churchill, Rept. U. S. Fish. Comm. for 1919, 1–51, 1921.
5 H. F. Prytherch, Appendix 11, Rept. U. S. Fish. Comm., Doc. 961, 1–14, 1923.
6 P. S. Galtsoff, *Collecting Net*, 4: 10, 277–278, 1931.
7 P. S. Galtsoff, *Proc. Nat. Acad. Sci.*, 16–9, 555–559, 1930.
8 H. F. Prytherch, *Bull. U. S. Bur. Fish.*, 44, 429–503, 1929.

HANDEDNESS OF TWINS

THAT the members of an occasional pair of identical twins differ in unimanual handedness is a well-established fact. The reasons for such reversals, however, have long been a matter of controversy. Newman and his school believe such reversals occur in those pairs in which division of the embryo occurred relatively later in embryonic development than in those pairs in which no reversals are manifest. The supposition is that in the former instance certain irreversible developments have taken place prior to separation of the embryos, thus one resulting embryo would be similar to the right and the other to the left side of what would have been a single individual had no separation taken place. According to this system of reasoning, identical twins showing less similarity in general appearance should show more reversals in handedness and other bilateral traits. The above theory has met with considerable criticism by various students of twins, in that no significant correlation has ever been shown to exist between the general similarity in features and appearance and the degree of reversal in handedness.

For several years the writer has noted that in both identical and fraternal twins showing reversals in unimanual handedness, an apparently high percentage of such pairs have one or more left-handers among their immediate relatives. An opportunity to obtain a considerable amount of pertinent data was afforded the writer by an invitation to attend a recent[1] twin party at Waterville, Maine. The party was sponsored by Mr. Welton P. Farrow to celebrate the visit of his identical twin brother, whom he had not seen for nineteen years.

Close to two hundred pairs of twins attended the party. The finest cooperation was given to the writer and his assistants, and data were obtained on the unimanual handedness of 109 pairs of twins and their immediate families. These data, plus data previously obtained, were sufficient to permit a statistical analysis.

1 Held on August 16, 1938.

Out of a total of 82 pairs of identical twins alike in handedness, 19 pairs or 23.1 per cent. have one or more left-handed relatives in their immediate families. Out of a total of 20 pairs of identical twins showing reversals in handedness, 11 pairs or 55 per cent. have one or more left-handed relatives in their immediate families. The difference in the percentage occurrence of left-handed relatives of the two groups is 31.9 per cent. $\pm$ 11.37,[2] a significant amount.

Interestingly enough, the same type of analysis of fraternal twins gave strikingly similar results. Out of a total of 50 fraternal pairs having the same handedness, 9 pairs or 18 per cent. have one or more left-handers in their immediate families, whereas among fraternals showing reversals in handedness, 8 out of 14 pairs, or 57.1 per cent., have left-handers in their immediate families. Here the difference in the percentage occurrence of left-handers among the relatives of the two groups is 39.1 per cent. $\pm$ 14.09, again a significant difference.

These findings thus indicate conclusively in both types of twins that left-handedness occurs more frequently among the relatives of those pairs showing reversals than among the relatives of pairs alike in unimanual handedness. The most probable explanation would seem to be that handedness is a quantitative trait and that in embryos which are genotypically near ambidexterity, if twinning occurs, the unusual position in utero is sufficient to shift handedness one way or the other. We should naturally expect to find a higher percentage of such genotypes in families with left-handers. In fraternal twins, of course, we have somewhat different heredities in the members of a pair and might thus expect to find a higher percentage of reversals than in identicals, who have the same genotype.

In a total of 139 pairs of identicals, we found 22 pairs or 15.8 per cent. to have reversal in handedness, whereas in 81 pairs of fraternals, 18 pairs or 22.2 per cent. Thus, according to our data, reversals occur in 6.4 per cent. $\pm$ 5.3 more cases of fraternal than identical twins. While this difference is not sufficient to be statistically significant, it rather definitely refutes the contention of some to the effect that reversals in handedness occur more frequently in identical than in fraternal twins.

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"MANIFESTO" BY A PHYSICIST

MANY scientists must have been profoundly disturbed by the revelations of recent events as to what the implications of the totalitarian philosophy of the state really are. There would seem not to be room on the same planet for totalitarian states and states in which the freedom of the individual is recognized. Many scientists must have been moved to try to find something to do about it. In my own case this urge to find something to do has resulted in the decision to close my laboratory to visits from citizens of totalitarian states. I have had the following statement printed, which I hand to any prospective visitor who may present himself.

Statement

I have decided from now on not to show my apparatus or discuss my experiments with the citizens of any totalitarian state. A citizen of such a state is no longer a free individual, but he may be compelled to engage in any activity whatever to advance the purposes of that state. The purposes of the totalitarian states have shown themselves to be in irreconcilable conflict with the purposes of free states. In particular, the totalitarian states do not recognize that the free cultivation of scientific knowledge for its own sake is a worthy end of human endeavor, but have commandeered the scientific activities of their citizens to serve their own purposes. These states have thus annulled the grounds which formerly justified and made a pleasure of the free sharing of scientific knowledge between individuals of different countries. A self-respecting recognition of this altered situation demands that this practice be stopped. Cessation of scientific intercourse with the totalitarian states serves the double purpose of making more difficult the misuse of scientific information by these states, and of giving the individual opportunity to express his abhorrence of their practices.

This statement is made entirely in my individual capacity and has no connection whatever with any policy of the university.

Science has been rightly recognized as probably the one human activity which knows no nationalisms; for this reason it has been a potent factor making for universal civilization. Action such as this is therefore to be deeply deplored and to be undertaken only after the gravest consideration. But it seems to me that the possibility of an idealistic conception of the present function of science has been already destroyed, and the stark issues of self-survival are being forced upon us. Perhaps the only hope in the present situation is to make the citizens of the totalitarian states realize as vividly and as speedily as possible how the philosophy of their states impresses and affects the rest of the world. Such a realization can be brought about by the spontaneous action of the individual citizens of the non-totalitarian states perhaps even more effectively than by their governments. Here I think is one of the few conceivable situations in which the popular conception of the social "responsibility" of "science" can touch at all closely the individual scientist.

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[2] S.E. difference.