SCIENCE

VOL. 98 FRIDAY, JULY 2, 1943 No. 2531

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE ORIGIN OF LANGUAGE[1]

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NOBODY knows when, where or how speech originated, and I am stepping in where wise scholars in linguistics and psychology fear to tread. My colleagues in psychology will, I beg, permit this divagation into speculation by one who has labored long in the less exciting fields of experiment and statistics. I ask and expect no mercy from experts in linguistic science, but only that they build a better theory on the ruins they make of mine.

We must first glance at three time-honored and then dishonored theories, now known by these opprobrious names: ding-dong theory, bow-wow theory and pooh-pooh theory.

The ding-dong theory assumed a mystical power of certain things to evoke certain sounds from men. Since each such sound was associated with the experience of the thing, it came to mean it. And since men were alike in their responses to things by sounds, one of these sounds meant more or less the same thing to all in the group, and easily became a vehicle of communication. All the evidence is against the existence of any such mystical power, and only extremely strong evidence would induce any scientific student of psychology or of language to put any faith in so extremely unlikely an origin of language.

The bow-wow theory supposed that men formed habits of using the sounds made by animals, things or events to mean the respective animals, things and events and that these habits started them on the road to inventing other sounds as signs of animals, things or events. For various reasons this theory is discredited. Doubtless after man has language, he will

[1] A lecture given on November 5, 1942, as one of the series of the William James lectureship at Harvard University.

grow after subjection to this process; and secondly, if so, whether the lifespan was increased. This paper reports the survival and growth of orchid seeds when vacuum dried after freezing at low temperatures.

A miniature, "lyophile" apparatus[2] described by Flosdorf and Mudd[3] was used, and with slight modifications the procedures outlined by these authors were applied to orchid seeds. The seeds used were the results of two primary crosses, *Cattleya Loddigesii* crossed upon *Cattleya Schroederiana* and *Laelia anceps* crossed upon *Cattleya Trianaei*. These species are natives of either Brazil, Colombia or Mexico and grow in climates where freezing temperatures are unknown or unusual.

In comparison with seeds of most flowering plants, those of orchids are very small. The ones used in this experiment measured on an average 527.7 μ by 73.5 μ. They had been stored for 7 months in a glass jar in a refrigerator. Their moisture content was not determined before they were "lyophiled" nor after, at the time of planting. The percentage of moisture in seeds of another cross stored in the refrigerator under similar conditions for 4 months has been found to be 1.5 per cent. The residual moisture which Flosdorf and Mudd found remaining in bacterial preparations after subjection to the "lyophile" process was 0.5 per cent.[3]

Two sets of tubes were prepared for desiccation. In one, sterile blood serum (commonly utilized in the preservation of bacteria by this method) was used as the suspending fluid and in the other, autoclaved coconut liquid. A mass of seeds which would approximate two drops of water in volume was placed in each tube. The tubes were plugged with sterile cotton and thoroughly agitated so that the seeds became completely coated with the liquids. This required some manipulation, for, due to the structure of orchid seeds, the outer alar cells resist wetting. The tubes were plunged into the dry ice bath of the main condenser of the apparatus at a temperature of −78° C. for about three minutes until thoroughly frozen. They were then attached to the vacuum manifold, being kept immersed at the same time in a dry ice bath maintained at −5° to −10° C. The vacuum pump was started and dehydration allowed to proceed for three to four hours. At the end of the second hour, the tubes were removed from the cold bath and held at room temperature. They were sealed off while under vacuum with an oxygen flame. These procedures (using the same volume of suspending fluid, degree of vacuum and time of desiccation) had given consistently satisfactory results with this apparatus in the preservation of bacteria.

[2] Made available through the courtesy of the Department of Bacteriology at the University of Washington, Seattle, Wash.

[3] E. W. Flosdorf and S. Mudd, *Jour. Immunol.*, 29: 389–425, 1935.

Half of the tubes were stored for future tests of viability. The other half were broken open and the contents planted. Following Knudson's technique[4] for growing orchid seeds non-symbiotically, they were planted aseptically on a nutrient agar medium using a slightly modified Knudson's Solution B[4] with sucrose as the sugar and the pH 6.3. Some of the contents of the tubes were planted directly from the tubes while others were first sterilized with hypochlorite solution after Wilson's method.[5] No immediate contamination resulted from either of these procedures.

None of the seeds which had been immersed in blood serum germinated. All but one tube of those suspended in coconut liquid not only germinated but, with the exception of a few flasks which later became contaminated, grew satisfactorily. One flask containing seeds of *Cattleya Loddigesii* crossed upon *Cattleya Schroederiana* germinated within the short period of seven days, which was four days before the controls showed signs of germination. After four months, most of the seedlings had two leaves and one or two roots and were sufficiently large to remove from the containers and plant into community pots.

Although various kinds of seeds have survived exposure to low temperatures after varying degrees of drying,[6] to our knowledge this is the first time that seeds have been subjected to the "lyophile" process and have grown. Seeds of the tuberous begonia and snapdragon, which are roughly 2 to 10 times the size of orchid seeds, were similarly treated but failed to survive and grow.

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[4] L. Knudson, *Bot. Gaz.*, 73: 1–25, 1922.

[5] J. K. Wilson, *Amer. Jour. Bot.*, 2: 420–427, 1915.

[6] B. J. Luyet and P. M. Gehenio, *Biodynamica*, Normandy, Missouri, 1940.

[7] Formerly with the University of Washington.

BOOKS RECEIVED

COLEMAN, LAURENCE VAIL. *Company Museums.* Illustrated. Pp. viii + 173. American Association of Museums. $2.50.

FREEMAN, FRANK N. and M. A. WENGER. *The Chicago Mental Growth Battery.* Illustrated. Pp. v + 58. The University of Chicago Press. $1.00.

JOHNSON, WILLIAM H. and LOUIS V. NEWKIRK. *Fundamentals of Electricity.* Illustrated. Pp. x + 212. Macmillan. $2.00. *Fundamentals of Shopwork.* Illustrated. Pp. viii + 200. Macmillan. $2.00.

LUCK, JAMES MURRAY. *Annual Review of Physiology.* Pp. vii + 613. Annual Reviews, Inc. $5.00.

SARGENT, PORTER. *War and Education.* Pp. 506. Porter Sargent. $4.00.

TULEEN, LAWRENCE F., GEORGE S. PORTER and ARTHUR HOUSTON. *Prepare Yourself.* Illustrated. Pp. vi + 298. Scott, Foresman and Company. $0.96.