Discussion. In biology, the lognormal distribution function occurs relatively frequently (KOCH[9,10]), and has been used as a convenient distribution to describe various phenomena. In logarithmically proliferating organisms, the lognormality is directly associated with their exponential growth. SCHERBAUM et al.[11]), who studied the theoretical relationship between cell growth and their volume distribution in the *Tetrahymena*, arrived at the conclusion that even a linear volume growth in an exponentially proliferating cell population generates a lognormal volume distribution. The reason for this relationship is the age distribution of the organisms which is also exponential. In such a distribution, the number of young and small organisms is twice that of old and large organisms. The present study advances this argument even further. Since in each cell cycle phase the age distribution of the organisms is exponential, it seems natural that their volume distribution is lognormal (Figures 3 and 4).

In view of the present method in which the area of the organism was traced and computed, one is faced with the question as to whether the distributions so generated reflect the true shape volume distributions similar to those determined with the Coulter Counter. Actually each cell could be viewed as a cylinder whose base is the cell area 'S' and height the cell width '*h*'. Its volume V would be $V = hS$. Provided that h is constant, if S is distributed lognormally, hS has to be distributed lognormally also. By spreading the organism on subbed slides as described above, the variability of h is minimized and for all practical purposes could be viewed as constant. Since the distribution of all the organisms pooled together (Figure 7) exhibits a typical lognormal distribution, like any other *Tetrahymena* volume distribution measured electronically, the variability of h has to be low, otherwise the pooled distribution would deviate markedly from lognormality.

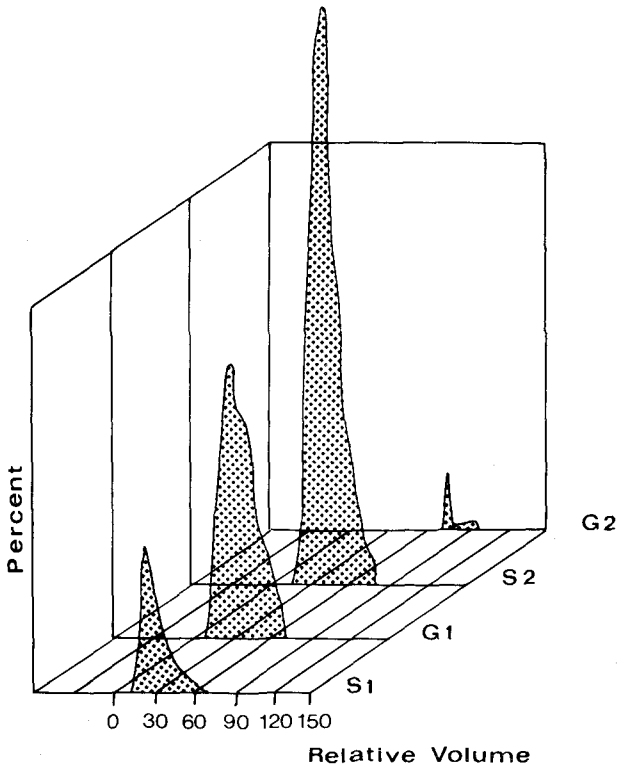


Fig. 6. Volume frequency distribution of *Tetrahymena pyriformis* in various cell cycle phases. Experiment No. 2. S-1; S-2; G-1; G-2; explained in Figure 2.

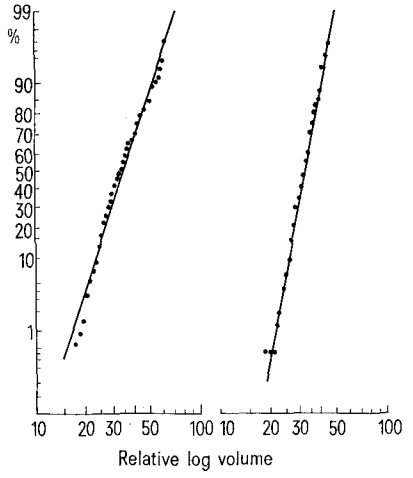


Fig. 7. Cumulative lognormal volume distribution of *Tetrahymena pyriformis*. Left figure: Experiment No. 1. Right figure: Experiment No. 2.

[8] D. M. PRESCOTT and G. E. STONE, in *Research in Protozoology* (Ed. T. T. CHEN; Pergamon Press, Oxford, London, New York 1967), vol. 2, p. 117.
[9] A. L. KOCH, Theoret. Biol. *12*, 276 (1966).
[10] A. L. KOCH, Theoret. Biol. *23*, 251 (1969).
[11] O. SCHERBAUM and G. RASCH, Acta path. microbiol. scand. *41*, 161 (1957).

Enhancement of Fe Absorption by Mn in Rice Roots (*Oryza sativa* L.)

S. KANNAN

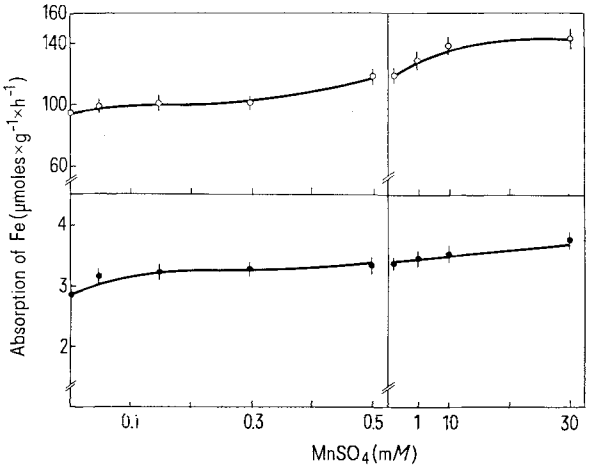
Biology and Agriculture Division, Bhabha Atomic Research Centre, Bombay 400085 (India), 5 February 1976.

Summary. The rates of absorption of Fe by excized rice roots were measured in the absence and presence of different concentrations of $MnSO_4$. Fe absorption from 0.1 and 5 m*M* $FeSO_4$ was enhanced by $MnSO_4$ at concentrations above 0.1 and 5 m*M*, respectively.

Fe and Mn are micronutrients essential for plant growth, and because of their close chemical relationship, they play a significant role in their mutual absorption by plant roots. Mn absorption is generally inhibited by the presence of Fe[1,2], and there is evidence that Mn interferes with Fe utilization in chlorophyll synthesis rather than Fe trans-

[1] S. KANNAN, Plant Physiol. *44*, 1457 (1969).
[2] S. RAMANI and S. KANNAN, Commun. Soil Sci. Plant Anal. *5*, 427 (1974).

location from the root to the shoot[3]. The effects of Mn on the absorption of some monovalent cations were investigated[4], and it was found that Mn inhibited the uptake of Na from 0.1 m*M* NaCl and that of K from 5 m*M* KCl. Mn also reduced the absorption of Ca and Zn[5]. In contrast, the present study reveals that the effect of Mn on the absorption of Fe is different from those on other cations reported earlier[4,5].



Absorption of Fe from 0.1 m*M* (●—●) and 5 m*M* (○—○) $FeSO_4$ by excized rice roots, in the absence and presence of different concentrations of $MnSO_4$. The absorption medium contained 0.1 m*M* $CaSO_4$, besides others. The vertical bars are the standard errors of the mean.

Fe absorption was measured by suspending excized rice (*Oryza sativa* L. cv. I.R. 8) roots[6] in ^{59}Fe labelled $FeSO_4$ solutions (sp. act. 0.1 μCi/μmole, pH 5.5) containing various concentrations of $MnSO_4$. 5 replicate samples were used for each concentration. At the end of the experiment, the roots were desorbed in unlabelled cold (5 °C) solutions and radioassayed in a γ-ray spectrometer. The concentrations of $MnSO_4$ were similar to those of mechanisms 1 and 2 of EPSTEIN[7] and were chosen to understand the ion interactions.

The results (Figure) show that Fe absorption from 0.1 m*M* $FeSO_4$ is enhanced by the presence of $MnSO_4$ at concentrations above 0.1 m*M*. The absorption from 5 m*M* $FeSO_4$ is significantly increased by $MnSO_4$ above 0.5 m*M*. The findings suggest that rice roots, which are generally grown under submerged conditions, have a capacity to absorb Fe in a manner different from other plant roots. The exact mechanism, however, is not known. There is no evidence to suggest that Mn could bring about a change in the configuration of the ion-carrier and thus influence the uptake of other cations. However, this possibility is rather remote, because such an effect on the configuration would influence the uptake of other ions in a more or less similar manner, and our studies[4,5] reveal that this is not true. The present investigation further shows that chemically similar ions need not to be antagonistic to each other in their absorption, at least in some plant species.

[3] S. KANNAN and B. JOSEPH, Plant Physiol. *55*, 1006 (1957).
[4] S. RAMANI and S. KANNAN, Z. Pflanzenphysiol. *77*, 107 (1976).
[5] S. RAMANI and S. KANNAN, Z. Naturforsch. *31*, 12 (1976).
[6] S. KANNAN, Planta *96*, 262 (1971).
[7] E. EPSTEIN, Int. Rev. Cytol. *34*, 123 (1973).

Subcellular Distribution of Acetylcholinesterases in the Neural Lobe of the Bovine Pituitary Gland

H. VILHARDT[1] and RUTH V. BAKER

Department of Pharmacology, University of Oxford, Oxford (England), 13 March 1976.

Summary. Biochemical analysis of subcellular fractions of bovine neural lobe tissue indicated that non-specific acetylcholinesterase was principally associated with the pituicytes.

In cholinergic transmission of nerve impulses, the acetylcholine released is inactivated by degradation by acetylcholinesterase. In the central nervous system, both specific acetylcholinesterase and non-specific acetylcholinesterase activity can be demonstrated[2,3]. The specific enzyme activity seems to be found mainly in neurons[2,4–6], whereas the non-specific esterase is principally located in the glial cells[3,7,8]. This is in accordance with the early finding by BÜLBRING et al.[9] that glial cell tumors are particularly enriched in the non-specific esterase.

The principal constituents of the neural lobe of the pituitary gland are the neurosecretory nerve endings and the pituicytes. The nerve endings are the distal projections of neurons of the hypothalamo-neurohypophysial system originating in perikarya located in the supraoptic and paraventricular nuclei of the hypothalamus. The nerve endings contain the hormones vasopressin and oxytocin, which are secreted from the neural lobe.

In the neural lobe, acetylcholinesterase activity has been demonstrated both biochemically[10,11] and at the ultrastructural level[12]. The concentration of non-specific acetylcholinesterase in neural lobes from rats and rabbits was generally found to be lower than that of the specific enzyme[10,11]. The histochemical study by BRIDGES et al.[12] indicated that in the rabbit neural lobe pituicytes mainly exhibited non-specific acetylcholinesterase activity, whereas nerve fibres identified as neurosecretory terminals occasionally displayed specific acetylcholinesterase activity.

In the present study, homogenates of bovine neural lobes were subjected to subcellular fractionation by ultracentrifugation. The distribution of acetylcholinesterases among the fractions was examined and compared with the distribution of other marker substances.

Materials and methods. Freshly collected bovine neural lobes were homogenized in ice-cold 0.3 *M* sucrose and subjected to differential centrifugation: 800 g_{av} for 15 min (I), 3000 g_{av} for 15 min (II), 5000 g_{av} for 15 min (III), 26,000 g_{av} for 15 min (IV), and 100,000 g_{av} for 60 min (V) leaving the final particle-free supernatant (VI). All operations took place at 4 °C.

The fractions were resuspended in 5 m*M* *Tris*-HCl (pH 7.5) and assayed for protein[13], vasopressin by the method of DEKANSKI[14] as described by VILHARDT and HOPE[15], succinate dehydrogenase[16] as modified by PORTEOUS and CLARK[17], lactate dehydrogenase[18] as modified by PICKUP and HOPE[19], $Mg^{2+}+Na^{+}+K^{+}$-AT-