[2] Wilkinson, S. G., Galbraith, L., and Lightfoot, G. A., *Eur. J. Biochem.*, **33**, 158-174 (1973).
[3] Wilkinson, S. G., *Biochim. biophys. Acta*, **187**, 492-500 (1969).
[4] Wilkinson, S. G., and Bell, M.E., *Biochim. Biophys. Acta*, **248**, 293-299 (1971).
[5] Wilkinson, S. G., *Biochim. biophys. Acta*, **164**, 148-156 (1968).
[6] Baker, K., *Lab. Prac.*, **17**, 817-824 (1968).
[7] Stanier, R. Y., Palleroni, N. J. and Doudoroff, M., *J. gen. Microbiol* **43**, 159-271 (1966).
[8] Ballard, R. W., Doudoroff, M., Stanier, R. Y., and Mandel, M., *J. gen. Microbiol.*, **53**, 349-361 (1968).
[9] Minnikin, D. E., Abdolrahimzadeh, H., and Baddiley, J., *Biochim. biophys. Acta*, **249**, 651-655 (1971).
[10] Nutter, L. J., and Privett, O. S., *J. Chromatogr.*, **35**, 519-525 (1968).
[11] Dittmer, J. C., and Lester, R. L., *J. Lipid Res.*, **5**, 126-127 (1964).
[12] Baddiley, J., Buchanan, J. G., Handschumacher, R. E., and Prescott, J. F., *J. chem. Soc.*, **2818**, (1956).
[13] Palleroni, N. J., Ballard, R. W., Ralston, E., and Doudoroff, M., *J. Bact.*, **110**, 1-11 (1972).
[14] Minnikin, D. E., Abdolrahimzadeh, H., and Baddiley, J., *Biochem. J.*, **124**, 447-448 (1971).
[15] Minnikin, D. E., Abdolrahimzadeh, H., and Baddiley, J., *FEBS Lett.*, **27**, 16-18 (1972).
[16] Laine, R. A., Griffin, P. F. S., Sweeley, C. C., and Brennan, P. J., *Biochemistry*, **11**, 2267-2271 (1972).
[17] Rouser, G., Yamamoto, A., and Kritchevsky, G., *Arch. int. Med.*, **127**, 1105-1121 (1971).
[18] Wilkinson, S. G., *Biochim. biophys. Acta*, **270**, 1-17 (1972).

## New approach to study of oxygen transport in plants using chemiluminescent method

THE possibility that roots are aerated by molecular oxygen transported from the shoots continues to attract attention. A number of methods have already been involved in the study of this phenomenon, namely, polarography[1,2], labelled oxygen[3,4], enzyme investigations[5,6], and electron microscopy[7–9]. Nevertheless, the physiological role of this factor in the oxygen regime of the plant's roots remains unresolved and the data obtained in different laboratories vary.

Here we introduce a chemiluminescent method for tackling this problem. The phenomenon of an ultraweak glow (UG), or biochemiluminescence, discovered by Italian scientists[10], takes place in plant and animal tissues only in the presence of oxygen[11]. We chose this glowing of the roots, or the lack of it in anaerobic conditions, as a test for the transport of oxygen from the shoots to the radical zone of the pumpkin.

The roots of 25 pumpkin seedlings, 4–5 d old with expanded cotyledons, were submerged in Knop's solution. They were about 7–8 cm long and the solution level came to about 0.5–1 cm above the point of root attachment to the shoot—the rest of the shoot remaining in air. The intensity of the root UG (450–650 nm with a maximum of 530 nm) was measured, mainly from the middle and lower parts of the roots, by means of a quantometer apparatus. Experimental details will be described in full later.

When air was bubbling through the solution, a UG of the root was seen but when nitrogen was bubbled through the solution the intensity of the UG began to decrease sharply and after 2 h had practically ceased (Fig. 1). Stopping the passage of nitrogen failed to change the picture even though the shoots remained in air. Only the repeated bubbling of air through the solution led to a rapid increase of the roots' UG.

It is worth noting that other investigators have demonstrated that in the pumpkin[12] and other mesophytes[13,14], oxygen is not only transported from the parts of the plant above the ground to the roots but also partially flows out from the roots to the environment. Further studies of the factors responsible for these discrepancies are being made.

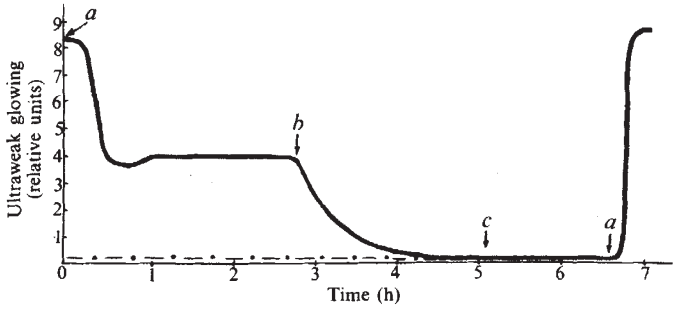


**Fig. 1** Ultraweak glowing of pumpkin roots in different conditions of radical zone aeration. *a*, Bubbling by air; *b*, bubbling by $N_2$; *c*, stopping bubbling by $N_2$. o-o-o-o, Noise of apparatus (background).

B. B. VARTAPETIAN
L. P. AGAPOVA
*Timiriazev Institute of Plant Physiology, Academy of Sciences, Botanicheskaya Street, 35, Moscow 127273*

A. A. AVERIANOV
V. A. VESELOVSKY
*Department of Biophysics, Moscow University, Moscow 117234*

Received November 20, 1973.

[1] Vartapetian, B. B., *Soviet Pl. Physiol.* **11**, 659 (1964).
[2] Armstrong W., *Nature*, **204**, 801 (1964).
[3] Jensen, C. R., Letey, J., and Stolzy, L. H., *Science*, **144**, 550 (1964).
[4] Barber, D. A., Ebert, M., and Evans, N. T. S., *J. exp. Bot.*, **13**, 397 (1962).
[5] Crawford, R. M. M., *J. Ecol.*, **54**, 405, (1966).
[6] McManmon, M., and Crawford, R. M. M., *New Phytol.*, **70**, 299 (1971).
[7] Vartapetian, B. B., Andreeva, I. N. Davtian N. G., and Maslova I. P., *Soviet Pl. Physiol.*, **15**, 13 (1968).
[8] Vartapetian, B. B., *Molecular oxygen and water in cell metabolism*, (Nauka, Moscow, 1970).
[9] Vartapetian, B. B., Andreeva, I. N., Maslova, I. P., and Davtian, N. G., *Agrochimica*, **15**, I, (1970).
[10] Colli, U., Facchini, G., Guidotti, G., Dygnani-Lonati, R., Orsenigo, M., and Sommariva, O., *Experientia*, **11**, 12 (1955).
[11] Tarusov, B. N., Ivanov, I. M., and Petrusevich, V. M., *Ultraweak glowing in biological systems* .(Moscow State University Publishers, Moscow; 1967).
[12] Brown R., *Ann. Bot.* (new series), **11**, 417 (1947).
[13] Greenwood, D. J., *New Phytol.* **66**, 337 (1967).
[14] Healy, M. T., and Armstrong, W., *Planta*, **103**, 302 (1972).

## Cell-free studies of developmental changes in synthesis of α-foetoprotein and albumin in the mouse liver

ALPHA foetoprotein (αFP) is an α-globulin present in foetal and early postnatal sera of various animal species. It is not normally detectable in adult serum by the immunodiffusion test, but in several pathological conditions, particularly primary hepatomas, the level of αFP increases to a significant level. The potential use of this phenomenon in early diagnosis of hepatomas has been explored. These and related studies on αFP and other 'foetal-tumour antigens' have been reviewed recently[1–5].

In addition to the possible clinical application, αFP may provide an unique opportunity for the understanding of the relationship between embryonic development and malignant transformation. It has been shown that αFP is synthesised in the yolk sac and liver, but the basic mechanisms for the synthesis and its regulation are essentially unknown. This