Effect of a purified cotton dust extract on human lung in culture

J.H. EDWARDS, ELIZABETH EVANS, P.H. EVANS, P.J. NICHOLLS & K.T. RAJAN

M.R.C. Pneumoconiosis Unit, Llandough Hospital, S. Glam., Welsh School of Pharmacy, UWIST, and University Hospital of Wales, Cardiff

The lung function changes observed in byssinotic cotton workers following the inhalation of cotton dust have been attributed to the presence of a water-soluble pharmacologically active agent in the dust (McKerrow, McDermott, Gilson & Schilling, 1958). Indeed, Davenport & Paton (1962) described the presence of several pharmacological activities in such dust extracts. There is accumulating evidence that the acute lung function changes may be associated with the presence of histamine releasing activity in the dust (Bouhuys, 1974). Recently, the major histamine-releasing component of cardroom cotton dust has been isolated by thin layer chromatography and tentatively identified as an aminopolysaccharide-protein complex (Evans & Nicholls, 1974). As part of an examination of the pharmacological properties of this substance, its action upon human lung in culture has been investigated.

Lung lobules from 8-12 week-old human embryos were maintained in organ culture in a synthetic medium (BGJ5; Biggers, Gwatkin & Heyner, 1961) containing 15% w/v foetal calf serum and ascorbic acid, 150 μg/ml (Reynolds. 1972). The organ culture technique of Trowell (1954) as modified by Dingle, Fell & Lucy (1966) was employed. The medium was changed on alternate days and cultures were maintained for 8 days at 37°C in an atmosphere of O_2 (50%) and CO_2 (5%). Under these conditions, the cultures remained viable for 8 days and there was growth and differentiation as seen by light microscopy. Some explants were maintained in media containing the cotton dust aminopolysaccharide-protein complex.

Of 12 explants examined there were no abnormalities demonstrated histologically when incubation was in the control medium and in media containing the dust fraction at a concentration of 200 μg/ml. However, explants exposed to this material in a concentration of 400 μg/ml showed the following features: (a) tissue necrosis, most marked in the broncial epithelium and (b) in areas where the bronchial epithelium was intact, marked exudate in the lumen consisting of PAS-staining material and numerous necrotic cells. There was also a marked increase in the amount of the lysosomal enzyme β-glucuronidase released from lung into the medium by this higher concentration of the cotton dust fraction at 2, 4, 6 and 8 days in culture. This was additional to a low level of β-glucuronidase activity exhibited by this concentration of the aminopolysaccharide-protein fraction alone.

E.E. is in receipt of a Victor Reed Scholarship from the Pharmaceutical Society of Great Britain.

References

BIGGERS, J.D., GWATKIN, R.B.L. & HEYNER, S. (1961). Growth of embryonic avian and mammalian tibiae on a relatively simple chemically defined medium. *Exp. Cell. Res.*, **25**, 41-58.

BOUHUYS, A. (1974). *Breathing: Physiology, Environment and Lung Disease*, pp. 422-431. New York and London: Grune and Stratton.

DAVENPORT, A. & PATON, W.D.M. (1962). The pharmacological activity of extracts of cotton dust. *Br. J. industr. Med.*, **19**, 19-32.

DINGLE, J.T., FELL, H.B. & LUCY, J.A. (1966). Synthesis of connective tissue components. The effect of retinol and hydrocortisone on cultured limb-bone rudiments. *Biochem. J.*, **98**, 173-181.

EVANS, E. & NICHOLLS, P.J. (1974). Preliminary characterization of the histamine releasing activity of cotton dust. *J. Pharm. Pharmac.*, **26**, 115-116P.

McKERROW, C.B., McDERMOTT, M., GILSON, J.C. & SCHILLING, R.S.F. (1958). Respiratory function during the day in cotton workers: a study in byssinosis. *Br. J. industr. Med.*, **15**, 75-83.

REYNOLDS, J.J. (1972). Skeletal tissue in culture. In *The Biochemistry and Physiology of Bone*. Vol. 1. Second edn. New York: Academic Press.

TROWELL, O.A. (1954). A modified technique for organ culture *in vitro*. *Exp. Cell. Res.*, **6**, 246-248.