PATHOLOGY

Growth Inhibition of Mouse Ascites Tumour Cells by Powdered Tragacanth (Tragacanthæ Pulvis, B.P.)

DURING experiments designed to explore possible short-term effects of 'Busulphan' (1 : 4-dimethanesulphonyloxybutane or 'Myleran') on mouse ascites tumour cells, the drug was injected intraperitoneally in suspension in arachis oil or in an aqueous solution of compound powder of tragacanth into $C+$ male mice bearing the Landschutz ascites tumour. Neither the arachis oil suspension of 'Busulphan' nor the oil alone produced any inhibition of tumour cell growth. However, both the suspension of 'Busulphan' in compound powder of tragacanth solution and the tragacanth solution alone totally inhibited the tumour, as judged by absence of ascites tumour cells (and of solid tumour) seven days after injection of 25 mgm. of the compound in $\frac{1}{2}$ c.c. water or saline. The same result was obtained after a lower dose of the powder (2·5 mgm. per mouse), in all cases injected one day after the inoculation of the tumour cells. A dose of 10 mgm. per mouse in a 3-day-old tumour prolonged longevity two-fold (longevity in days for treated: control tumour-bearing animals = 33 : 16). Of other tumours tested, total inhibition was also obtained at a dose of 2·5 mgm. per mouse seven days after inoculation of the *Bp*8 ascites tumour in *C3H* mice; but no effect was observed by intravenous or subcutaneous administration to $C+$ mice bearing a solid subcutaneous implant of the $C+$ leucæmia. (This arose in the Chester Beatty Research Institute as a spontaneous lymphocytic leucæmia in $C+$ mice.)

The compound powder of tragacanth had been compounded for pharmaceutical purposes from four components in the proportions: powdered tragacanth 1·5, powdered acacia 2·0, maize starch 2·0 and sucrose 4·5. Parallel tests of 2·5 mgm. of the compound (in 0·5 c.c. saline) per mouse and of proportionate amounts of these four components showed that at these concentrations the tragacanth powder was the growth inhibitory agent. Most of the recent tests have been carried out with this sample of tragacanth powder, that is, a sample of Persian origin, B.D.H., B.P. No. 2.

For example, by intraperitoneal injection into the Landschutz ascites tumour in $C+$ male mice, 3 mgm. tragacanth powder given to mice bearing a 3-day-old tumour increased the longevity of the mice in the ratio 33 : 18; and in another experiment 2 mgm. of the powder tested against 3-day-old tumours gave a longevity increase of 54 : 19. 5 mgm. powder per animal in a 7-day-old tumour resulted in a longevity increase of 23 : 18 or, on the basis of a total tumour cell count 14 days after the tumour cell inoculation, in a ratio, number of ascites tumour cells in control animals: number in treated animals (that is, $C/T_{(14)}$) of 32. Similar results have been obtained for the *Bp*8 ascites tumour in *C3H* male mice, the Crocker ascites tumour in stock mice, and the $C+$ leucæmia (ascites) treated intraperitoneally in $C+$ mice. However, administration of the tragacanth in the drinking water (68 mgm. per mouse, that is, about 10 mgm. daily for 7 days) produced no inhibition of the Landschutz ascites tumour (cells counted 7 days after inoculation, that is $C/T_{(7)} = 1{\cdot}09$).

No inhibitory action has been detected in the solid tumour tested (Crocker tumour in stock mice) when 52 mgm. tragacanth powder per mouse was taken freely in drinking water over an 8-day period, or when 160 mgm. was given by forced feeding in the same period. At the end of the latter experiment the animals were in poor condition, although no ill-effect was observed after tragacanth administered in drinking water. Administered intraperitoneally, larger doses of the agent are tolerated in animals bearing older tumours.

Tests have been initiated using tragacanth samples of different commercial grades. Their inhibitory activity varies with the sample and the first results suggest that Indian tragacanth powders (gum Karaya, from *Sterculia urens*) and Persian flake powders (from *Astragalus gummifer* Labillardiere) are non-inhibitory at non-toxic doses; while Persian ribbon powders, which are from *A. gummifer* from a different habitat are inhibitory at quite low, non-toxic doses, for example, 2 mgm. per mouse gave a $C/T_{(7)}$ of 60 to infinity.

It is of interest that a gum tragacanth was tested against the Ehrlich ascites tumour in mice by Oettel and Wilhelm[1] and was reported to have no effect on tumour size, average body weight or average survival time for treated animals compared with controls, at a dose of 25 mgm. per kgm. body-weight, that is, five daily doses of 5 mgm. per kgm., commencing injections 2 hr. after tumour inoculation. At a dose of 250 mgm. per kgm. body-weight (50 mgm. × 5 daily doses) there were small reductions in treated animals in all three quantities measured, that is, a ratio for treated to control mice of 3·5 : 4·7 for average ascites tumour weight (gm.), of +0·5 : +1·2 for average body-weight change (gm.), and 12·5 : 15·7 for average survival time (days), suggesting a toxic effect at this dose level. A single injection of 1–2 mgm. per mouse in our experiments (normally to mice weighing initially 21–24 gm.) is intermediate between the doses tested by Oettel and Wilhelm and has a significant tumour-inhibitory effect even on a 3-day-old tumour. It is possible, therefore, that the sample of gum tragacanth used by these authors is similar in origin to those found non-inhibitory in our tests.

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[1] Oettel, H., and Wilhelm, G., *Cancer Res.*, Supp. No. 2, 143 (1955).

BACTERIOLOGY

Function of Carotenoids in Photosynthetic Bacteria

A RELATION between photosensitivity and the loss of carotenoid pigments has been observed in *Rhodopseudomonas*[1], *Chlorella*[2], *Chromatium*[3], *Chlamydomonas*[4], *Rhodospirillum*[5], *Corynebacterium*[6] and *Zea mays*[7]. Sistrom *et al.* have suggested that photosensitization in the carotenoidless mutant of *Rhodopseudomonas spheroides* '. . . is a specific consequence