The phenomenon of macromolecular uptake in the adult intestine has now generally been accepted. Most authors agree that the degree of absorption is nutritionally insignificant, but that the penetration of the intestinal epithelium by antigenic macromolecules may be of immunological importance [1, 2]. This absorption of intact macromolecules is thought to occur predominantly by transcellular endocytosis and may be involved in the pathogenesis of food allergies and inflammatory bowel diseases.

Recently, however, interest has centered on the uptake of intact proteins in the gut as a potential route for the therapeutic administration of biologically active peptide drugs and vaccines. We have been using an improved everted gut sac system [3] to study the uptake of a non-toxic lectin from tomatoes, a dietary glycoprotein of molecular weight, 71 kDa, as it has been shown to be taken up intact by rat and human intestine in vivo, to bind to the intestine without causing any deleterious effects [4] and to have potential for slowing gastrointestinal transit [5]. Quantification and characterization of the uptake of this lectin will be useful in evaluating its potential as an adjunct to drug delivery in the gastrointestinal tract.

Everted gut sacs were prepared from the small intestines of adult male Wistar rats and incubated for times up to 2 h in 10 ml of tissue culture medium 199 at 37°C in the presence of 125I-labelled tomato lectin (2 μg/ml). Sacs were removed from the flasks at intervals, blotted dry and the serosal fluid was also linear, but much slower, the rate being 1.7 ng/h per mg of protein. Passage into the serosal

incubating gut sacs in increasing concentrations of lectin over a 1 h period at 37°C. This showed that tissue uptake and serosal transfer rose linearly until a maximum rate was reached at a concentration of approximately 15 μg/ml, when all the lectin-binding sites were saturated. These experiments together showed lectin uptake to be temperature and concentration dependent, and that the mechanism of uptake was absorptive endocytosis.

The fact that tomato lectin adhered to the gut surface, showed increased uptake when compared to controls and accumulated to a large degree within the mucosal cells may indeed give it potential as an adjunct to drug delivery within the gastrointestinal tract.


Received 23 March 1989

Uptake of tomato lectin by the adult rat small intestine in vitro

BARBARA NAIBETT and JOHN WOODLEY
Department of Biological Sciences, University of Keele, Staffs ST5 5BG, U.K.

Fig. 1. Uptake of 125I-labelled tomato lectin (a) compared with controls (b)

(a) Uptake of 125I-labelled tomato lectin by everted gut sacs at 37°C into mucosal tissue (■) and serosal space (○), and at 4°C into mucosal tissue (△) and serosal space (○). Each point is the mean of 16 replicates. (b) Uptake of 125I-labelled BSA at 37°C into mucosal tissue (△) and serosal space (○), and uptake of 125I-labelled PVP at 37°C into mucosal tissue (■) and serosal space (○). Each point is the mean of 16 replicates.

Abbreviations used: BSA, bovine serum albumin; PVP, polyvinylpyrrolidone.