BIOCHEMICAL JOURNAL LETTERS

Carbohydrate and protein conformation

In a recent paper, Van Holst *et al.* (1986) provided evidence for a change in the polypeptide conformation of potato lectin (*Solanum tuberosum* agglutinin) after deglycosylation with trifluoromethanesulphonic acid. Kilpatrick *et al.* (1984) deduced that a similar change had taken place when the closely related tomato (*Lycopersicon esculentum*) lectin was similarly treated. These observations may have wider implications for lectin structure within the Solanaceae, and also possibly for the role of the carbohydrate moiety in glycoproteins.

Some years ago, we prepared an antiserum to the lectin found in *Datura stramonium* seeds and used it to demonstrate that several tissues within the *Datura* plant, and several tissues in separate species of the Solanaceae, possessed cross-reacting lectins (Kilpatrick *et al.*, 1980). By using three separate antisera and increasing the number of extracts tested, I have been able to extend substantially the list of cross-reacting lectins within the Solanaceae (Table 1).

Each antiserum was raised against the appropriate purified lectin, and was monospecific; the preparations and characteristics of the antisera have previously been

described in detail (Kilpatrick *et al.*, 1980, 1984; Ashford *et al.*, 1982).

It has been suggested that such serological cross-reactivity is due solely to antibodies recognizing a common oligosaccharide structure, and that each lectin also has an antigenically distinct domain(s) against which antibodies only form in response to the immunizing lectin (Ashford *et al.*, 1982; Allen, 1983). This is possible but inherently surprising, since polypeptide is generally more immunogenic than carbohydrate and one would expect lectins from closely related species (and from tissues of the same species) to have more in common than a rather monolithic carbohydrate structure. Although there is little doubt that the cross-reactivity between tomato, potato and *Datura* lectins depends on the integrity of the glycosylated region of those molecules, as discussed elsewhere (Allen, 1983; Kilpatrick *et al.*, 1984), the molecular basis of this may be more indirect. It could be that the cross-reacting antibodies are actually specific for peptide epitopes, but the structure of these epitopes depends upon a conformation maintained by the carbohydrate moiety. Deglycosylation, by changing the conformation, might destroy the structure of the epitope(s).

Table 1. Cross-reactivity of lectins from the Solanaceae

Homogenates were prepared by grinding appropriate tissues from *Datura stramonium*, tomato, potato, sweet pepper (*Capsicum annuum*) and woody nightshade (*Solanum dulcamara*) plants with a pestle and mortar in phosphate-buffered saline, removing insoluble material by centrifugation, and adjusting the protein concentration to 1.5 mg/ml. Each homogenate was tested by Ouchterlony double diffusion against rabbit antisera raised against the *Datura* seed lectin (anti-DL), the tomato fruit lectin (anti-TL) or the potato tuber lectin (anti-STA) and the thickness of the precipitation bands estimated on a + to + + + + scale. Lectin activity is expressed as the reciprocal of the agglutination titre obtained using fresh human erythrocytes.

Homogenate	Serological activity			Lectin activity
	anti-DL	anti-TL	anti-STA	
<i>Datura</i> seeds	+ + + +	+	+	512
<i>Datura</i> leaf	+	—	—	0
<i>Datura</i> pericarp	+	+	+	20
Tomato seed	+	—	—	2
Tomato leaf	+	—	+	4
Tomato pericarp	+	+ + + +	+	512
Potato seed	+	+	+	128
Potato leaf	+ +	+ +	+ +	256
Potato pericarp	+ +	+ +	+ +	512
Potato tuber	+ +	+ +	+ +	512
<i>Capsicum</i> seed	+ +	—	—	1
<i>Capsicum</i> leaf	—	—	—	0
<i>Capsicum</i> pericarp	+	—	+	0
<i>S. dulcamara</i> seed	+	—	+	0
<i>S. dulcamara</i> leaf	+ +	+ +	+	256
<i>S. dulcamara</i> pericarp	—	+	—	0

The stabilization of a particular protein conformation by carbohydrate may be a peculiarity of solanaceous lectins, which after all have an unusual carbohydrate structure and very high carbohydrate content (Desai *et al.*, 1981). Alternatively, maintenance of an active conformation may be a general function of carbohydrate in glycoproteins. In support of this suggestion could be cited the association of carbohydrate and thermal stability of enzymes (Pazur *et al.*, 1970), resistance to proteolysis (Gottschalk & Fazekas de St Groth, 1960), resistance to denaturation by tannins (Strumeyer & Malin, 1970), changes in solubility characteristics (Lawson *et al.*, 1983), and a variety of recognition phenomena (Olden *et al.*, 1982). In all these examples, the influence of carbohydrate structure on glycoprotein characteristics could be secondary to the preservation of a preferred polypeptide conformation.

David C. KILPATRICK
Regional Blood Transfusion Centre,
The Royal Infirmary,
Edinburgh EH3 9HB,
Scotland, U.K.

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