

Sharon N & Lis H. Lectins: cell-agglutinating and sugar-specific proteins.

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This article reviews the history of research on lectins since their discovery at the turn of the century, their specificity with respect to monosaccharides and cells, and the properties of purified lectins, in particular concanavalin A. Their enormous potential for studying the structure of complex carbohydrates, and especially of cell surfaces, is demonstrated. [The SCI® indicates that this paper has been cited over 930 times since 1972.]

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"Our involvement with lectins is another example of the unpredictability of scientific research. It started in the early-1960s in the course of studies on soybean proteins, carried out in collaboration with E. Katchalski (then head of our department) under a project supported by the US Department of Agriculture. The purpose of this project was to provide knowledge leading to improved utilization of these proteins in human nutrition. We chose to concentrate on the hemagglutinin known to be present in soybeans, not only because of its possible deleterious effect on the nutritional properties of raw soybeans and soybean oil meal, but more importantly because earlier work<sup>1</sup> indicated that it may be a glycoprotein. At the time, research on glycoproteins was in its infancy, and nothing was known about the occurrence of such compounds in plants.

"We soon proved that soybean agglutinin is indeed a glycoprotein,<sup>2</sup> and thus demonstrated for the first time that plants contain glycoproteins. Although this aspect of soybean agglutinin still occupies our attention,<sup>3</sup> by the late-1960s we became interested in its

biological properties. This was prompted by reports in the literature that the lectins wheat germ agglutinin and concanavalin A agglutinated preferentially malignant transformed cells. We found, in fact, that soybean agglutinin also possesses the same remarkable property.<sup>4</sup>

"This coincided with the surge of interest in cell membranes and in the key role of cell surface sugars in growth, differentiation, and malignancy. It became obvious to us that the sugar specificity of lectins makes them excellent cell surface probes, capable of giving new insights into the structure and function of the cell surface.

"Although there were a couple of books and several reviews on lectins, none of them dealt with their molecular properties, nor did they emphasize the enormous potential of lectins in biological research. The need for such a review was therefore apparent. In 1970-1971 one of us (Sharon) spent his sabbatical in the department of biochemistry at the University of California, Berkeley, where he discussed extensively with his host, C.E. Ballou, the possible role of carbohydrates as information and recognition molecules. He further suggested to D.E. Koshland, Jr., from the same department, who was also a member of the editorial board of *Science*, to write a review on lectins for that journal, a suggestion which was readily accepted. Writing was started in the fall of 1971 by Sharon in London, when he was Royal Society Visiting Professor in the laboratory of A. Neuberger at St. Mary's Hospital Medical School, and was completed by both authors early in 1972 in Rehovot.

"The review drew very favorable comments from our colleagues who found it both timely and of great interest to a broad spectrum of scientists. We believe that its continued high rate of citation is the result of the tremendous growth in studies on lectins and their applications in biology, immunology, and medicine. Indeed, within one decade these long neglected proteins with esoteric properties have become a household word in numerous laboratories."<sup>5,6</sup>

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