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Preface

"It is the customary fate of new truth to begin as heresies and to end as superstitions"

Thomas H. Huxley

The central theme of current molecular cell biology is structure and function of proteins. Essentially all cell biologists believe that cellular activity can be understood in terms of protein function as enzymes, transporters, receptors, signal transducers, mediators of cell adhesion, controllers of motility, etc. Similarly, medical scientists believe that diseases can be understood in terms of alteration of protein structure and function. By extension, most glycobiologists assume that carbohydrate functions can be explained in terms of interaction of carbohydrate with proteins.

The concept of carbohydrate-to-carbohydrate interaction as a basis of cell recognition and adhesion can be regarded as "heresy". We scientists contributing to this special volume do not intend to be heretics, but rather "loyal to nature" students trying to learn the properties of carbohydrates that mediate cell-to-cell or cell-to-receptor interaction. I personally began by studying the compaction of mouse embryo, and autoadhesion of teratocarcinoma F9 cells which mimics compaction, and found that these processes were somehow mediated by a specific carbohydrate termed Le^x, cooperating with E-cadherin. It was natural to look for an Le^x-binding protein possibly involved in these processes. However, no such protein was found; instead, the process was based on Le^x-to-Le^x interaction.

A similar situation was encountered by Max M. Burger and colleagues as they tried to clarify the molecular basis of species-specific sponge cell autoaggregation. Since the mediator of this process was proteoglycan, elucidation of the mechanism and exclusion of possible protein involvement required a long time and great effort. They finally ended up with a beautiful model of glycan self-recognition.

The concept of carbohydrate-to-carbohydrate interaction has been supported and greatly enhanced by results of many studies using synthetic chemistry and biophysical analytical techniques that make it possible to precisely determine specificity and strength of binding affinity. Many of these studies are described in the papers in this issue, by the expert chemists, biochemists, and biophysicists who conducted them.

This is not a summary of current status of this topic. Rather, it represents highlights of interesting recent work and an invitation to molecular cell biologists, glycobiologists, and particularly bioorganic chemists to join this exciting new trend of study. Known examples of glycans involved in carbohydrate-to-carbohydrate interaction are still highly limited. There is great room for improvement of methodologies.

I hereby gratefully acknowledge Prof. Hans Vliegenthart for inviting me to organize this issue.

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