

clearly influenced by the degree of hyperglycemia and/or insulin deficiency.<sup>5-9</sup> Although one can argue whether these biochemical mechanisms can be clearly implicated in the pathophysiology of the major complications of diabetes, they do provide us with many provocative and exciting biochemical models to explore further—both in terms of the direct roles of the known mechanisms in the pathophysiology of complications and in terms of related pathways in other tissues. For example, whereas the glycosylation of hemoglobin per se may or may not have anything to do with the pathophysiology of diabetic complications, it does provide a concrete model for alteration of both protein structure and function on the basis of ambient level of glucose.<sup>10-13</sup> It is unlikely that hemoglobin is unique among all body proteins in being so affected. Indeed, there is evidence emerging that several other proteins undergo similar glycosylation. The role of such glycosylation in the development of complications is not yet defined, but any process that alters both structure and function of proteins can be envisaged as having potentially powerful effects.

Finally, the Brussels study is yet another chapter in those clinical studies that invariably support the relationship between higher levels of hyperglycemia and more frequent and/or more severe complications. I have not yet seen any clinical study that shows any benefit for “poor” control.

It seems to me that the time has come to stop bickering about the desirability of good control. Rather, we should focus our attention on the best means of achieving good control, and determining the optimum degree of control required and desirable. I clearly recognize that that decision may vary with circumstances and that the degree of control attainable by conventional methods may vary somewhat among patients. Something approaching euglycemia, however, is attainable in many patients, and this should be our goal in most cases. To say that it is not attainable is to deny the documented experience of dedicated practitioners. It may indeed be hard to achieve and may require the concerted efforts of patients and professionals. It won't be easy, and attempts at attaining euglycemia will be complicated by occasional hypoglycemic episodes. But rather than have an irrational and unwarranted fear of hyperglycemia, I accept the infrequent, mild, recognizable hypoglycemic episode as both a useful educational tool for the patient (in terms of symptom recognition) and as an indication that glucose levels are close to the desirable range. (I do strive to avoid frequent, severe, nocturnal, or unrecognizable hypoglycemic episodes.) The misguided (in my view) efforts to avoid hypoglycemia at the expense of accepting hyperglycemia are not justified by any available data. It's time to stop making excuses for not achieving euglycemic control and start expending the effort in trying to do so.

JSS

## REFERENCES

- <sup>1</sup> Engerman, R. L., Bloodworth, J. M. B., and Nelson, S.: Relationship of microvascular disease in diabetes to metabolic control. *Diabetes* 26: 760-69, 1977.
- <sup>2</sup> Howard, C. F.: Basement membrane thickness in muscle capillaries of normal and spontaneously diabetic Macaca Nigra. *Diabetes* 24: 201-6, 1975.
- <sup>3</sup> Mauer, S. M., Sutherland, D. E. R., Steffes, M. W., Leonard, R. J., Najarian, J. S., Michael, A. F., and Brown, D. M.: Pancreatic islet transplantation: effects on the glomerular lesion of experimental diabetes in the rat. *Diabetes* 23: 748-53, 1974.
- <sup>4</sup> Mauer, S. M., Steffes, M. W., Sutherland, D. E. R., Najarian, J. S., Michael, A. F., and Brown, D. M.: Studies of the rate of regression of the glomerular lesions in diabetic rats treated with pancreatic islet transplantation. *Diabetes* 24: 280-85, 1975.
- <sup>5</sup> Spiro, R. G.: Search for a biochemical basis of diabetic microangiopathy. *Diabetologia* 12: 1-14, 1976.
- <sup>6</sup> Gabbay, K. H.: Hyperglycemia, polyol metabolism, and complications of diabetes mellitus. *Annu. Rev. Med.* 26: 521-26, 1975.
- <sup>7</sup> Winegrad, A. I., and Greene, D. A. Diabetic polyneuropathy: the importance of insulin deficiency, hyperglycemia, and alterations in myoinositol metabolism in its pathogenesis. *N. Engl. J. Med.* 295: 1416-21, 1976.
- <sup>8</sup> Brownlee, M., and Cahill, G. F. Diabetic control and vascular complications. *Arteriosclerosis Reviews*, 1978, in press.
- <sup>9</sup> Koenig, R., Peterson, C., Jones, R., Saudek, C., Lehrman, M., and Cerami, A.: Correlation of glucose regulation and hemoglobin A<sub>1c</sub> in diabetes mellitus. *N. Engl. J. Med.* 295: 417-20, 1976.
- <sup>10</sup> Bunn, H. F., Haney, D. N., Gabbay, K. H., and Gallop, P. M.: Further identification of the nature and linkage of the carbohydrate in hemoglobin A<sub>1c</sub>. *Biochem. Biophys. Res. Commun.* 67: 103-9, 1975.
- <sup>11</sup> Bunn, H. F., and Briehl, R. W.: The interaction of 2,3-diphosphoglycerate with various human hemoglobins. *J. Clin. Invest.* 49: 1088-95, 1970.
- <sup>12</sup> Bunn, H. F., Haney, D. N., Kamin, S., Gabbay, K. H., and Gallop, P. M.: The biosynthesis of human hemoglobin A<sub>1c</sub>. *J. Clin. Invest.* 57: 1652-59, 1976.
- <sup>13</sup> Bunn, H. F., Gabbay, K. H., and Gallop, P. M.: The glycosylation of hemoglobin: relevance to diabetes mellitus. *Science* 200: 21-27, 1978.

## Sulfonylurea Drugs 1978

**T**he proper role of oral hypoglycemic agents in our therapeutic armamentarium has been clouded by emotional reactions and heated debate that have obscured the real issues. The genesis of this debate is clearly the reports of the UGDP and the positions taken by authorities in response to those reports.<sup>1</sup> So much has been written about the UGDP, pro and con, that it is not particularly beneficial to labor the question here. It is refreshing, then, to see a new approach taken to this subject—as has been done by Lebovitz and Feinglos in this

issue of DIABETES CARE.<sup>2</sup> Their concepts of the use of sulfonylureas are based on their own challenging studies on the mechanism of action of these agents, as well as those of others.<sup>3-6</sup> Because their concepts are different, their review should stimulate more controversy; however, the debate now should center on new issues rather than rehashing the old. Fortunately, the revolutionary position of Lebovitz and Feinglos is testable and can be supported or refuted by scientific data. Hopefully, a whole new era of investigation of sulfonylureas will be stimulated.

We hope, too, that there will be stimulation of a more enlightened attitude towards sulfonylureas on the part of the Food and Drug Administration. The UGDP study found ill effects only of tolbutamide and phenformin. No other sulfonylureas were studied. To implicate other drugs on the basis of similar chemical class is unjustified. If we had followed a similar course when problems developed with early penicillins or sulfonamides, we would have no antibiotics today. Some of the second generation sulfonylureas have been under clinical investigation in this country for more than a decade, and in use abroad even longer. Since these agents may be more potent than those currently marketed, they should be released unless there is evidence that they are dangerous. We should stop the politics and polemics, and proceed with defining appropriate groups of patients who may benefit from these agents.

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## REFERENCES

- <sup>1</sup> University Group Diabetes Program: A study of the effects of hypoglycemic agents on vascular complications in patients with adult-onset diabetes. I. Design, methods, and baseline characteristics. *Diabetes* 19 (Suppl. 2): 747-88, 1970; II. Mortality results. *Diabetes* 19 (Suppl. 2): 789-830, 1970; V. Evaluation of phenformin therapy. *Diabetes* 24 (Suppl. 1): 65-184, 1975; VI. Supplementary report on nonfatal events in patients treated with tolbutamide. *Diabetes* 25: 1129-53, 1976.
- <sup>2</sup> Lebovitz, H. E., and Feinglos, M. N.: Sulfonylurea drugs: mechanism of antidiabetic action and therapeutic usefulness. *Diabetes Care* 1: 189-98, 1978.
- <sup>3</sup> Lebovitz, H. E., Feinglos, M. N., Bucholtz, H. K., and Lebovitz, F. L.: Potentiation of insulin action: a probable mechanism for the antidiabetic action of sulfonylurea drugs. *J. Clin. Endocrinol. Metab.* 45: 601-4, 1977.
- <sup>4</sup> Feinglos, M. N., and Lebovitz, H. E.: Alteration of hepatic insulin receptors by glipizide. *Diabetes* 27 (Suppl. 2): 449, 1978.
- <sup>5</sup> Blumenthal, S. A.: Potentiation of the hepatic action of insulin by chlorpropamide. *Diabetes* 26: 485-89, 1977.
- <sup>6</sup> Olefsky, J. M., and Reaven, G. M.: Effects of sulfonylurea therapy on insulin binding to mononuclear leukocytes of diabetic patients. *Am. J. Med.* 60: 89-95, 1976.

**EDITOR'S NOTE:** We hope our readers will have commentary in reaction to our editorial positions and to articles published in DIABETES CARE. Letters to the Editor are an appropriate forum for response. We encourage you to write us.