In a previous report (Planten, 1975) the suggestion was made that the acute refractive change, which can occur in acute or unregulated diabetes and which is certainly situated in the lens, could be approached from the viewpoint of other known refractive changes in the lens.

It is known in practice that the developing, purely cortical cataract is usually accompanied by hypermetropia and the nuclear cataract by myopia. In the former the change is from one to a maximum of 3 diopters, after which the opacity becomes too pronounced to allow the refraction to be determined; in the latter the myopic change may rise to 10 or 12 diopters in a short time without the visual acuity being markedly affected, as the affected nucleus retains a homogeneous structure. The question is whether swelling or ‘sclerosis’ of the lens, with an associated increase or decrease of its curvature, is a causative factor. In that case a specific alteration in the weight of lenses affected with these cataracts might be expected.

We therefore took 46 random lenses with senile cataract after cryo-extraction and weighed them. The lenses included 14 typical nuclear cataracts and 7 obvious cortical cataracts, which had been responsible for refractive changes varying from -15 to +1.5 diopters; the rest showed a mixed cataract. Statistically no essential difference in the weights of the lenses was found, so that a connection between refractive change and weight is unlikely. This is in agreement with a similar observation by Fischer et al. (1973), who found that the water content of the lens was constant, whether ‘senile sclerosis’ was present or not.

An unexpected result was the significant difference between the weight of the lenses of male and female patients, the latter being lighter. In view of the observation of others (François et al., 1977) that the emmetropic eyes of women are really smaller than those of men, this is not such a surprising result. In the present connection it could even be indirect evidence that cataract formation has not even altered this difference, and thus has no effect on the weight of the lens.

A different approach was found in the ultrasonic A-scan of the eyes of diabetics in whom an acute refractive change had occurred. If we compared these scans with scans made after the refractive change had disappeared
again, it appeared that there had been no change: neither the thickness of
the lens nor its position in the eye had altered.

We could demonstrate the validity and reliability of these measurements
by scans of the eyes of young people at rest and in accommodation, in which
a reproducible shift in the anterior surface of the lens was seen to occur,
while the lens itself and its posterior surface remained in the same place. The
changes here are of the order 1 - 3 diopters, the same as in the diabetics.

This phenomenon has a chemical explanation, as demonstrated by
Patterson (1976) in his article 'Cell volume regulation in the lens'.

On the basis of these findings it seems probable that changes in the
refractive indices in the various layers of the lens are responsible for the
hypermetropia in acute diabetes. The quantities concerned in these cases
can be calculated with the help of Legrand's theoretical eye. To obtain a
change in refraction of 2 diopters with an anterior chamber of 3.1 mm, the
anterior surface of the lens would have to shift 0.5 mm, producing a change
in radius from 10.2 to 14.1 mm. The whole lens would have to shift ± 1.5
mm to obtain the same change in refraction. The refractive index of the
whole lens, however, only has to decrease from 1.42 to 1.41 to produce a
hypermetropia of 2 diopters.

Direct proof that the transitory acute hypermetropia which can arise in
patients with acute diabetes is due to alterations in the refractive indices of
the lens will be difficult to obtain, in view of the slight change in the
refractive index of the lens as whole necessary to produce this amount of
hypermetropia.

SUMMARY

From the weight of the lenses of patients with senile cataract, ultrasonic
measurements of the eyes of patients with acute diabetic refractive changes,