The lens of the eye has the unusual biological requirement to be optically clear. How that is achieved is not fully understood, but a very high degree of structural order and uniformity is considered essential.

We have identified two proteins that are very divergent members of the intermediate filament family of proteins that assemble into a unique cytoskeletal element called the beaded filament. Both of these proteins and the beaded filament are expressed only in the lens.

Using genetic engineering approaches we created mice that lack the beaded filament proteins, in an effort to determine beaded filament function. The lenses of these animals were able to develop and differentiate normally, achieving the high degree of structural order that characterizes the lens, but they were unable to maintain that order with age. Thus the structural order seen in the lens is inherently unstable, and the beaded filament serves to confer resistance to the age-dependent loss of structure.

We are now focused on determining how the beaded filament accomplishes its mission:

- What is the structure of the filament?
- What proteins link it to the plasma membrane?
- What membrane proteins is it linked to?
- What membrane domains are formed at these sites?

The study of beaded filament structure has lead to a more general consideration of intermediate filament structure. Toward this end we have adapted site directed spin labeling and electron paramagnetic resonance to the study of its structure.
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