You can quickly estimate the number of divisions needed to develop a human retina and multiply this by the frequency of the disease in humans. Then compare this with the number of divisions needed for a mouse retina and an estimate of the total number of mouse births. The numbers suggest that some mouseketeer or animal breeder should have seen a retinoblastoma. But naturally occurring retinoblastomas appear to be confined to humans. Why us?

The biochemical reasons are obscure, but the human retina seems to depend heavily on the accurate function of Rb. Apparently, other vertebrate retinas do not. This is not to say that the other vertebrates don't use Rb. The homozygous deletions in mice say emphatically that they do. From studies of the heterozygous *Rb-1* mice it seems that Rb protein is particularly important in certain adult mouse tissues as well. Jacks *et al.*² show that these heterozygotes develop pituitary tumours. So predisposition in mice is for pituitary tumours, in humans for retinoblastomas.

One of the quirks of science is how much timing matters in the development of ideas. If the retinoblastoma gene had been identified in mice first, it would be known as pituitarioma or CNSless or some other trick of our nomenclaturists. But whatever the course that has been followed, we have been led to an intriguing gene and its product. There are more surprises in store, I'm sure — don't you just love experiments that raise more questions than they answer? □

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Breaking out in spots

Harold Zirin

HIGH-RESOLUTION images of the Sun's surface, presented by C. U. Keller in this issue (*Nature* **359**, 307–308; 1992), show that it is covered by magnetic spots, diminutive relations of sunspots.

As discovered by Hale at the beginning of this century, sunspots are associated with strong magnetic fields, up to 3,500 gauss. But other apparently weaker fields cover the solar surface. Since 1973, J. O. Stenflo (*Sol. Phys.* **32**, 41–63; 1973) has championed the idea that

would be destroyed if they were weaker. In the original model, the pressure of the magnetic fields was contained because they were localized in 'invisible sunspots'. These, indeed, were eventually made visible at the Big Bear Observatory (H. Zirin & H. Wang *Astrophys. J.* **385**, L27–L29; 1992).

Also, fields never appear uniform in high-resolution magnetograms: rather elements as small as the limiting resolution can be seen. Keller's work now

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Rough with the smooth: the apparently featureless surface between sunspots is in fact crowded with tiny flux tubes no more than 180 km across.

these are in fact the poorly resolved images of much smaller and much stronger field elements. Over the years, Stenflo and his students have accumulated a lot of evidence supporting this case, until only a few die-hard conservatives, myself included, harbour doubts.

The problem is one of spatial resolution: our atmosphere, heated by the Sun, is so turbulent that it is hard to see anything smaller than 1 arcsecond, or 700 km, across. Thus the small elements of strong field cannot be seen as such and indirect techniques must be used. In his original work Stenflo used the ratio of magnetic fields measured in two atomic spectral lines which respond differently (through the Zeeman effect) to external fields and showed that the results could be explained only if the fields were very strong.

For the present work, Keller has used super-high-resolution images obtained from the Canary Islands by speckle-interferometric techniques to find very small bright points associated with magnetic fields. The smallest point resolved is remarkable, only 180 km across. The magnetograms show similarly high resolution.

The logic of the strong-field model is that the motions of the Sun's photosphere are so strong that small elements

shows that the elements must be less than 180 km across. The strong-field model requires field elements smaller than 100 km, the mean free path of radiation at the surface.

There are still plenty of problems. Keller finds that some magnetic elements change rapidly, something we almost never see in our data, which is more sensitive, but has lower resolution; and he finds the bright point intensity doesn't always match the magnetic field. He finds that magnetic elements over 300 km are mostly dark, which partly agrees with our results.

And although strong fields will be blurred in measurement, individual dark elements cannot absorb more than 100 per cent of the light, so the invisible spots must have a filling factor of at least 50 per cent. This requires a lower field strength. And it is remarkable that these field elements can last so long, certainly weeks, perhaps years, without breaking up. While the problem of just how big the elements are was to be solved by the Orbiting Solar Laboratory, cancelled last year, Keller's brilliant work shows that there are other means of tackling it. □

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