Don't write off 'junk' DNA

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LONG, stuttering sequences of DNA, previously dismissed as junk, may be there to help glue chromosomes together before cell division. Geneticists working on fruit flies have found that junk DNA at the middle of each chromosome—the "centromere"—sticks specially strongly to similar sequences. This means that the centromeres may also stick to each other, holding copies of chromosomes together at the start of cell division.

More than 90 per cent of the DNA in the genome of most organisms does not code for any protein (see "Message in a genome?", *New Scientist*, 12 August 1995, p 30). The highest concentration of genetic junk is at centromeres, which consist largely of a pattern of five or six letters of the genetic code repeated thousands of times over. During cell division, centromeres serve as the attachment points for the cellular cables that pull chromosomes apart after they have been duplicated.

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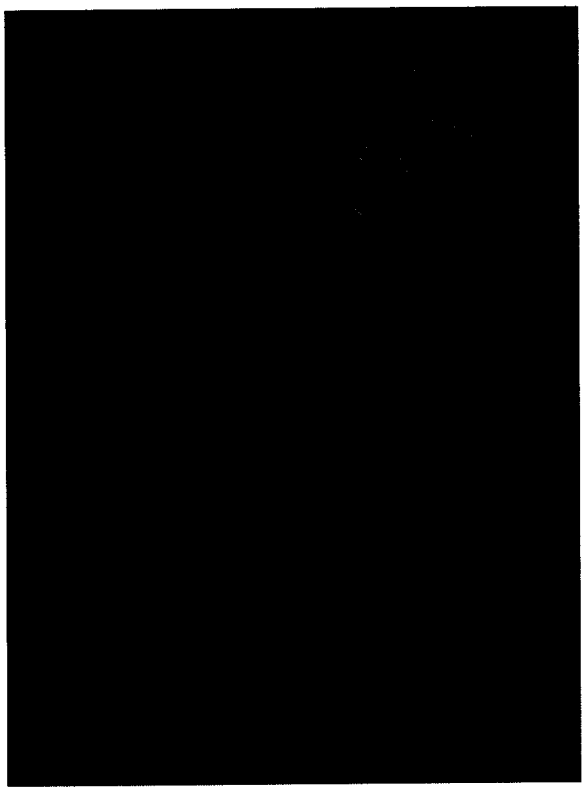

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Sticky customer: genetic junk may be chromosomes glue

Abby Dernburg, a PhD student at the University of California, San Francisco, and her supervisor John Sedat were investigating how isolated stretches of junk DNA positioned away from the centromeres could switch neighbouring genes off, preventing them from producing any protein. One theory was that these islands of junk DNA turn genes off by making them bind to the centromeres, where the normal cellular machinery of protein production does not seem to work.

To test this idea, Dernburg and Sedat studied a mutant fruit fly which has an island of junk DNA near a gene called *brown*. Fruit flies usually have red eyes, but if the *brown* gene is inactive, as in these mutants, the flies cannot make the red pigment and the eyes appear brown.

The geneticists "painted" different parts of one of the flies' chromosomes different colours, using short pieces of DNA that bind to known genetic sequences and carry fluorescent molecular tags. They tagged the *brown* gene pink and the centromere of the same chromosome orange. In normal flies, the pink and orange regions remained far apart. But in the mutants, they were always remarkably close (*Cell*, vol 85, p 745).

Dernburg and Sadat argue that the "stickiness" that held the *brown* gene at the centromere in the mutant flies normally binds the two members of a pair of chromosomes together at their centromeres in the early stages of cell division, when the chromosomes are duplicated. "Ever since junk DNA was discovered in the 1920s people have wondered why cells bother to carry so much around," says Dernburg. "We've shown that it is not just a parasite."

Duplicating a chromosome, and attaching the cellular cables that subsequently drag one chromosome copy to each end of the dividing cell takes time. If the junk DNA at the centromere did not act like glue, say the researchers, the chromosome copies could drift away randomly, resulting in daughter cells containing too few chromosomes, or too many. "This would be a genetic disaster," says Dernburg.

The finding that the *brown* gene in the mutant flies always stays close to the centromere provides "strong support for the idea that [junk DNA] is sticky", agrees Gary Karpen of the Salk Institute for Biological Studies in La Jolla, California. He and Dernburg believe that the junk DNA does not actually stick to itself. The real glue, they say, consists of as yet unidentified proteins that bind to DNA sequences and then to each other. □