Preface

The genes are much too small to be seen individually, but in certain stages many chromosomes show lengthwise patterns of knobs or bands that indicate their subdivision into genes. In par ticular, this happens during the early stages of meiosis. A pair of rye chromosomes at the beginning of meiosis. You notice the pattern of darkly stained knobs and faintly stained connecting strands. The pattern in the two partner chromosomes is the same, and pairing is exceedingly accurate, each knob in one chromosome lying next to the matching knob in its partner. It appears that it is the genes rather than the chromosomes as a whole that direct the pairing process. This ability of the genes to find and attract their exact counterparts is one of their many remarkable properties for which science has not yet found a satisfactory explanation.

Later on in meiosis the pattern will be lost because the chromosomes curl up and contract into the compact bodies. But when the next generation makes germ cells, each chromosome will again show its characteristic pattern, so that a trained cytologist can recognize every one of the seven chromosomes of rye by the pattern of its knobs. Giant chromosomes with beautiful and intricate patterns of dark and light bands are found in the salivary glands of the larvae of certain flies. Chromosomes in the salivary glands of Drosophila larvae. They are hundreds of times as long as ordinary chromosomes, and each of them has its own characteristic pattern of bands. They are also much thicker than ordinary chromosomes because each consists of a bundle of many strands, all with exactly the same pattern of bands. The way these bundles arise is interesting because it illustrates the extreme accuracy of chromosome replication. In the young larva, the chromosomes in the salivary glands are still thin. As the larva grows, the salivary glands grow too, but they do so in a particular way.

The cells, instead of making more cells by division, grow bigger and bigger without division. Their nuclei, too, grow bigger and bigger. Inside the nuclei, the chromosomes make replicas of themselves as they do in preparation for mitosis but, as there is no mitosis, the new chromosomes do not separate from the old ones. Instead, new and old chromosomes remain closely attached to each other and each, in turn, makes more replicas. This goes on repeatedly, and so accurately does each band make another band like itself that the whole bundle appears as one single thick banded thread. In addition, the partner chromosomes in the salivary glands are closely paired as in meiosis, so that each apparent chromosome represents one pair, and the nuclei of the salivary glands of Drosophila seem to have four chromosomes instead of the eight that are visible in ordinary cells. The pattern of bands corresponds to the pattern of underlying genes. This can often be seen in cases where a chromosome has lost a small piece through radiation or some other injury. The accuracy of chromosome replication is such that all descendants of the damaged chromosome lack exactly the same piece, and when such a damaged chromosome gets into a gamete, for instance an ovum, individuals are formed which lack the same chromosome piece in all their cells. The left part of a normal wing of Drosophila and above it, and at a very much higher magnification, a little section of one of the normal salivary gland chromosomes. The arrow points to a band which encloses a gene for wing shape. The right part of the same chromosome section in a fly which had received a damaged chromosome from its X-rayed father or mother.

The simple and lucid presentation of complicated topics in cloning, genetics and stem cell technology would prove to be very useful to students, researchers and teachers.

—Editor