CHAPTER 15

wide conservation of all *D. melanogaster* populations to the P+ condition within the last century.

The purpose of this chapter is to review the evidence for *P* element horizontal transfer that has accumulated during the last two decades. There are two main advantages to using *P* elements to study horizontal transfer. First, the *P* element is one of the best described eukaryotic transposable elements (Engels, 1989), and provided one of the earliest reports of transposable element horizontal transfer (Daniels et al., 1990)

other mutations, that disrupt coding sequences. These non-autonomous elements are unable to

1980s invariably carried *P* elements. In contrast, *P* elements were absent from strains collected more than 20 years earlier from around the world (Kidwell, 1979, 1983; Anxolabéhère et al., 1988). This was consistent with a recent *P* element invasion of the cosmopolitan species, *D. melanogaster* (Kidwell, 1979, 1983). Recent invasion was supported by a number of observations. Among these, it was observed that complete *P* elements from geographically dispersed populations of *D. melanogaster* were virtually identical (O'Hare and Rubin, 1983; Nitasaka et al., 1987) suggesting a recent common evolutionary origin.

The *P* element involved in the *D. melanogaster* horizontal transfer belongs to the canonical *P* element subfamily described above. Although characteristic of this species, the canonical *P* element is not found in any other species in the *melanogaster* species g19.02(gs)-972(g19(sae)[(There)32jw̋lent

FIGURE 15.2 Phylogenetic analysis of *P*

recent invasion by canonical *P* elements, each of the distinct subfamilies of *P* elements in the *saltans* and *willistoni* species groups may have a distinct evolutionary origin. Thus *P* element evolution in these two groups may be characterized by successive waves of horizontal transfer that have occurred at various times in the past. The relatively extreme sequence divergence seen in the non-canonical subfamilies compared with the relatively homogeneous canonical *P* element subfamily suggests that such non-canonical element invasions occurred in the distant past.

Multiple horizontal transfers in species of the *willistoni* and *saltans* species groups

Horizontal transfer can be inferred whenever species that are only distantly related carry identical, or extremely similar, transposable element sequences. This kind of inference cannot be used in the case of the *willistoni* and

reasons stated above this is very likely to be an underestimate. It can be concluded that canonical *P* elements have transferred horizontally be-

element to *D*. *mediopunctata* from a member of the *willistoni* or *saltans* groups: (1) *P* elements are

from *Drosophila sucinea* of the *willistoni* group showed no affinity to any of the other 91 sequences (Clark et al., 1995). Whereas nucleotide sequence divergence between this element and other sequences from the *saltans* and *willistoni* groups is about 35%, this sequence differs by

Clark, J.B., Kim, P. and Kidwell, M.G. (1998) *Mol. Biol. Evol.* **15**: 746–755.
Clark, J.B., Altheide, T.K., Schlosser, M.J. and Kidwell, M.G. (1995) *Mol. Biol. Evol.* **12**: 902–913.
Daniels, S.B., Peterson, K.R., Strausbaugh, L.D. et al. (1990) *Genetics* **124**: 339–355.