The three isozymes were quite distinct from one another in their developmental expression. Acid-PO showed maximum activity in the pre-pupating larvae. The activity of this isozyme dropped about 80% in pupae and remained low in both sexes for the remaining lifespan. In contrast, neutral-PO activity was quite low in the pre-adult stages, peaked at age 3 weeks in both sexes and then declined by about 60% with age. Alkaline-PO activity was lowest in the pupae. This isozyme appeared to peak briefly (age 1 week in females, age 5 weeks in males), but otherwise remained at relatively constant levels during adult life.

Specific activity (PO activity per mg protein) was also determined for each isozyme. This index of enzyme activity places two of the peaks at slightly later ages than were indicated by activity per mg body mass (neutral-PO in males at age 4 weeks, alkaline-PO in females at age 3 weeks). Otherwise the indices are in general agreement and portray similar developmental trends in the isozyme activity levels.

Armstrong et al. (1978) also measured the PO activity at pH 7.4 (corresponding to neutral-PO) across the lifespan of D.melanogaster. The developmental profile in that study was quite similar to that of neutral-PO in the present study. Armstrong et al. found peak neutral-PO activity at two weeks of age in female imagoes and at three weeks of age in male imagoes. The isozymes activity also declined precipitously with age, as in the present study. It appears that the developmental profile of at least this isozyme is quite reproducible.

We are currently analyzing the functional properties of each PO isozyme and the possible significance of these patterns of isozyme expression during Drosophila development and aging.

References: Armstrong,D., R.Rinehart, L.Dixon, D.Reigh 1978, Age 1:8-12; Layne,E. 1957, Methods in Enzymology, V3, S.P.Colowick & N.O.Kaplan (eds), Academic Press, New York, pp. 451-454.

Preston, C.R. and W.R.Engels. University of Wisconsin, Madison USNA. Movement of P elements within a P strain.

Wild strains of Drosophila melanogaster carry a family of movable genetic elements known as P elements. These elements are known to transpose at a high rate when crossed into laboratory, (M), strains having the condition known as M cytotype (Engels 1983). Though P element activity within a P strain (flies with P cytotype and P elements) is much reduced, the observations reported here demonstrate that transposition and excision still occur at significant and measurable frequencies.

By in situ hybridization of polytene chromosomes, we have seen changes in P element locations in branches of a P strain after the lines had been maintained separately for many generations. These changes presumably represent transpositional activity of P elements within P strains.

Π_2, a wild caught P strain from a Madison population was maintained as described previously (Engels & Preston 1979) through twelve generations of full-sib matings and five subsequent bottle stock generations. At that time, a single pair mating produced the adults that were branched into ten single female lines (lines a-j, see Figure). These branches were kept at room temperature (21°C) by single female matings for three generations and small mass (vial) generations thereafter. At approximately the same time, two more pairs were branched and subsequently maintained at a higher (28°C) and a lower (18°C) temperature in quarter-pint bottle populations. Π_2 20c is yet another line that was branched from the $\Pi_2 c_1$ line at generation 52 and maintained independently for twenty generations as a bottle stock.

After 77-80 generations for the room temperature and 28° lines and 47 generations for the 18° line, larvae were selected for in situ hybridization to P element sequences. The results (see Figure) show the variation of P element positions on the X chromosome within these lines. The number of larvae analyzed per branch line is shown to the right of each chromosome. In cases where more than one larva was examined, there was a possibility of detecting polymorphism (circled points) within the line. We looked at more slides of the "hot" and "cold" lines expecting more variability because of the larger population size. This proved to be especially true in the 28° line where each of the twelve P element sites was missing in at least one case.

Because P element DNA probes were unavailable when the Π_2 strain was isolated in 1977, P element sites of the original line at that time are unknown. However, because these branches all originated from a highly inbred stock, the observed differences must represent

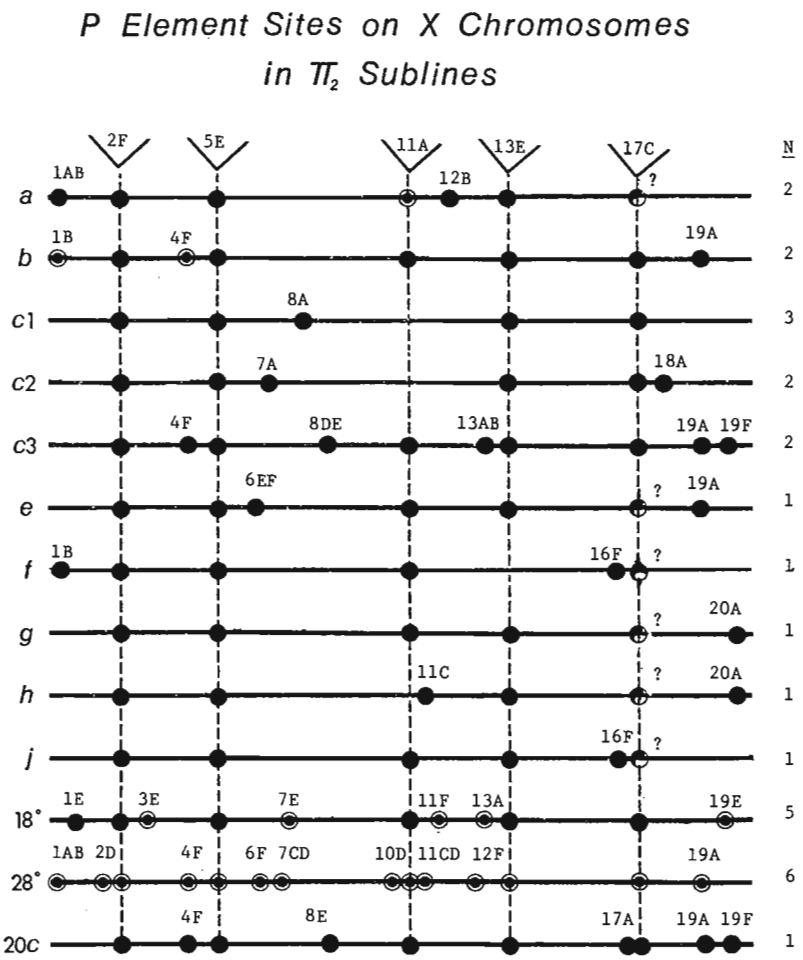

Figure 1. Horizontal lines depict X chromosomes of the Π_2 branch lines, and dots mark the positions of in situ hybridization. The probe in most cases was a 1:1 mixture of the HindIII fragment and the HindIII-SalI fragment internal to the complete P element (O'Hare & Rubin 1983). The rest of the slides were labeled with the pΠ25.1 probe which contains a complete P factor plus flanking sequences from position 17C. For those cases, the presence of a P element at 17C is uncertain, as indicated by the question marks in the Figure. Circled points represent polymorphic sites.

transpositions of P elements within P strain conditions. The vertical dashed lines show points of frequent (7 or more) sites which most likely represent the original Π_2 line. Several other sites, 1B, 4F and 19A, occur in several branches and may represent polymorphic sites in the original Π_2 stock prior to branching despite the close inbreeding.

To estimate the transposition and excision rates, we assume the original stock had X chromosomal sites at positions 2F, 5E, 11A, 13E and 17C, and that all changes indicate single, selectively neutral, events. If polymorphic sites are weighted by their observed frequencies, then the estimated rate of gain of sites is 0.29±0.005 per X chromosome per generation. The standard error is based on the assumption that these events have a Poisson distribution. We cannot estimate the rate of transposition on a per element basis since some of the donor sites might have been on the autosomes which were not monitored. Our estimate of the excision rate per element per generation (excluding the 17C element in cases where only the pΠ25.1 probe was used) is 0.0015±0.0006. These Π_2 stocks are apparently not in equilibrium since they are gaining sites more rapidly than they lose sites. We conclude that P transposition and excision occur at appreciable frequencies in the P cytotype. However, these rates are only approximately one thirtieth of rates previously estimated for the M cytotype (Engels & Preston 1981; Bingham et al. 1982).

References: Bingham,P.M., M.G.Kidwell & G.M.Rubin 1982, Cell 29:995-1004; Engels,W.R. 1983, Ann.Rev.Genet. 17:315-344; Engels,E.R. & C.R.Preston 1979, Genetics 92:161-175; Engels,W.R. & C.R.Preston 1981, Cell 26:421-428; O'Hare, K. & G.M.Rubin 1983, Cell 34.25-35.