Gingeras, T.R., H. Gelti-Douka and M.P. Kambysellis. New York University, New York. Yolk proteins in Drosophila.

Yolk proteins (vitellogenic proteins) have been extensively studied in many insects with emphasis on their identification and isolation (Telfer, 1953), hormonal regulation (Pan, M.L. and G.R. Wyatt, 1971) and site of synthesis (Hagedorn, H.H. and L.C. Judson, 1972).

We have initiated a project to study the genetic mechanisms regulating the synthesis and uptake of yolk proteins in Drosophila. We have been able to demonstrate by means of polyacrylamide gel electrophoresis, the presence of numerous proteins in the crude yolk extract of mature oocytes from several Drosophila species (Table 1). One of these proteins is predominant and represents 60-80% of the total egg proteins. We have found that the predominant yolk protein is also present in large quantities in the hemolymph of mature females, and is totally absent or present in very small quantities in males and newly emerged females (Figure 1). Partial purification of Drosophila yolk protein can be achieved by ammonium sulfate fractionation. For precipitation, the protein of D. virilis and D. hydei required 60% saturation, while 55% was necessary for D. mulleri. The molecular weight of the yolk protein (determined on 10% SDS polyacrylamide gels) was found to be in the range of 190,000 and appears to be identical for all the species analyzed. However, the electrophoretic mobility on 7.5% urea gels or 7.5% non-urea gels, pH 8.3, shows significant variability among the species, suggesting differences in the charge of the molecule. Furthermore, the yolk proteins from only some of the species gave immunoprecipitin lines (Table 1) when tested on Ouchterlony double diffusion immunoplates against antibodies prepared from D. virilis crude yolk extracts. The reaction appeared to vary among species, both qualitatively and quantitatively, and to parallel the presumed phylogenetic kinship of the species. Comparable results were obtained when yolk proteins were tested against antibodies prepared from D. melanogaster and D. silvestris crude yolk extracts. These results suggest that although the yolk proteins in Drosophila (at least in the species analyzed) are constant in MW, they have significant structural substitutions in different species. Such interspecific differences parallel the phylogenetic distance. (Supported by NSF Research Grant GB-34168.)

Table 1. Immunochemical reactions of Drosophila antibodies against crude yolk extracts from various Drosophila species.

Antibody yolk extract	virilis	melanogaster	silvestris
D. virilis	+	-	-
D. cardini	+	-	-
D. robusta	+	-	-
D. hydei	+	+	-
D. wheeleri	+	-	-
D. altrichi	+	-	-
D. melanogaster	-	+	-
D. subobscura	-	-	-
D. silvestris	-?	-	+
D. mimica	-	-	+
D. hamifera	-	-	+
A. aduncus	-	-	+

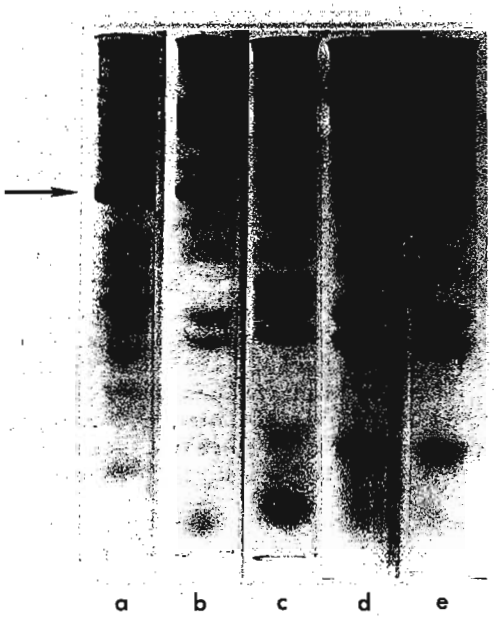

Figure 1. SDS polyacrylamide electrophoresis of D. silvestris.
a) crude yolk extract
b) female hemolymph (30 day old)
c) male hemolymph (30 day old)
d) female hemolymph (one day old)
e) male hemolymph (one day old)
(Arrow points at the yolk protein.)

References: Telfer, W.H. 1953, J. Gen. Physiol. 37:539; Pan, M.L. and G.R. Wyatt 1971, Science 174:503; Hagedorn, H.H. and C.L. Judson 1972, J. Exp. Zool. 182:367.