<Further Development 3.18>

Control of RNA Expression by Cytoplasmic Localization

Not only is the timing of mRNA translation regulated, but so is the place of RNA expression. A majority of mRNAs (about 70% in *Drosophila* embryos) are localized to specific places in the cell (Lécuyer et al. 2007). Just like the selective repression of mRNA translation, the selective localization of messages is often accomplished through their 3′ UTRs. There are three major mechanisms for the localization of an mRNA (see Palacios 2007):

1. *Diffusion and local anchoring.* Messenger RNAs such as nanos diffuse freely in the cytoplasm. When they diffuse to the posterior pole of the Drosophila oocyte, however, they are trapped there by proteins that reside particularly in these regions (FIGURE A).

Localized protection. Messenger RNAs such as those encoding the Drosophila heat shock protein Hsp83 float freely in the cytoplasm, but like nanos mRNA, hsp83 mRNA accumulates at the posterior pole. In contrast to nanos mRNA, hsp83 mRNA is degraded everywhere except at the posterior pole, where localized proteins protect the hsp83 mRNA from being destroyed (FIGURE B).

Active transport along the cytoskeleton. Active transport is probably the most widely used mechanism for mRNA localization. Here, the 3′ UTR of the mRNA is recognized by proteins that can bind these messages to "motor proteins" that travel along the cytoskeleton to their final destination (FIGURE C). We will see in Chapter 10 that this mechanism is very important for localizing transcription factor mRNAs into different regions of the *Drosophila* oocyte.

(See Further Development 3.19, Stored Messenger RNA in Brain Cells, online.)

FIGURE