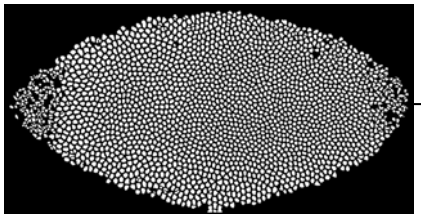
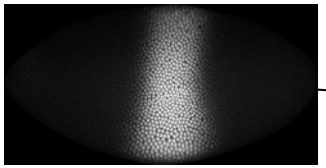
Reduction of Embryo Images to Expression Data

The two routines central to the task of creating numerical data on gene expression are the blob extractor and shape analysis.

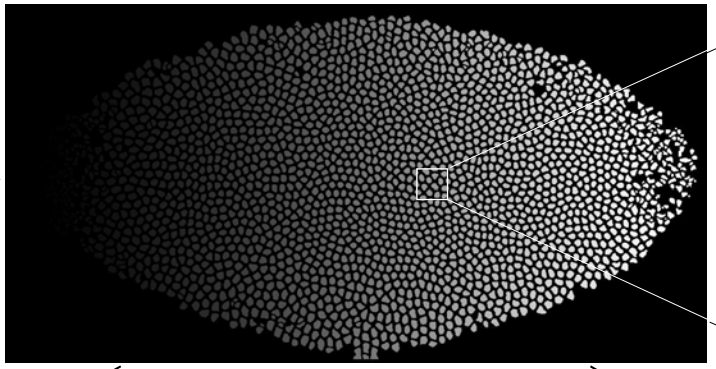
Nuclear Mask



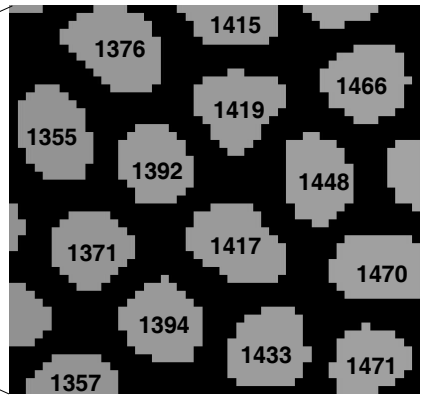
Kruppel greyscale



Labelled nuclear mask: in this image each "blob" is displayed with a unique greyscale value



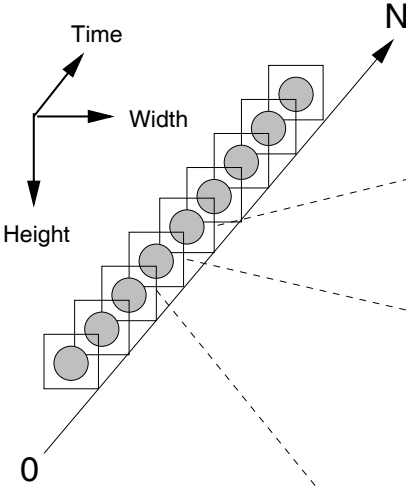
Blown-up view of the labelled mask



Blob Extractor

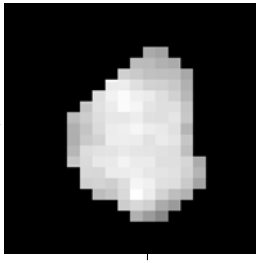
Shape Analysis

In essence, labeling makes groups of pixels and gives this group a numerical label, as shown above. Having identified such groups it is possible to calculate a number of statistics on it using the shape analysis routine. In particular, the average x and y location of all the pixels in a group (centroid) is calculated, thus defining the position of a nucleus.

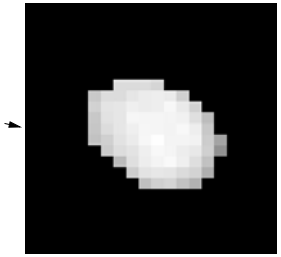


N= number of blobs in labelled image

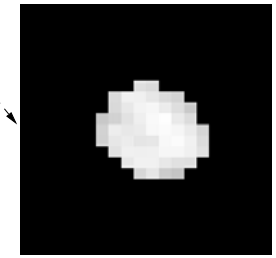
Nucleus "X+2"



Nucleus "X+1"



Nucleus "X"



The blob extractor decomposes a greyscale expression pattern into a series of subimages . Each subimage is composed of only those pixels under a single element of the labelled mask, and these subimages are arranged according to the numerical mask label along the Khoros "time" axis.

FINALLY,
The blob extractor operates separately on each of the three greyscale channels, and the three intensity averages are combined with the position measurements for each nucleus, which are expressed as a percentage of the total length and height of the embryo.

Here, the intensity values of each pixel from one of the greyscale gene channels under a single element of the labelled mask is displayed. These values are averaged, and this is the gene intensity value assigned to this nucleus.

									147	140							
								161	160	152	147						
							178	173	165	164	162	144					
						201	203	191	180	178	171	152					
				191	207	215	205	201	190	179	158						
			167	194	202	214	210	196	191	191	169						
		161	176	190	198	198	203	192	191	196	171						
		151	168	188	202	205	211	203	200	192	155						
		150	173	181	203	204	202	194	201	196	170						
		157	189	194	195	200	196	195	193	190	164						
		171	187	199	200	208	201	201	191	191	183	147					
			185	184	201	202	205	198	195	193	180	155					
			178	182	177	190	210	206	192	190	173	141					
				162	169	186	218	202	181	163	153						
						176	185	178	147	132							
							152	134	116								