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- Data mining
- Machine Learning
- Bioinformatics
- Appearance based recognition
  - **Classification of drosophila embryonic developmental stages based on gene expression pattern images**
    - *In Situ* staining of a target mRNA during the development of a drosophila embryo gives a detailed spatial-temporal view of the expression pattern of a given gene.
    - It also allows the capture of spatial gene interactions based on computational analysis of images

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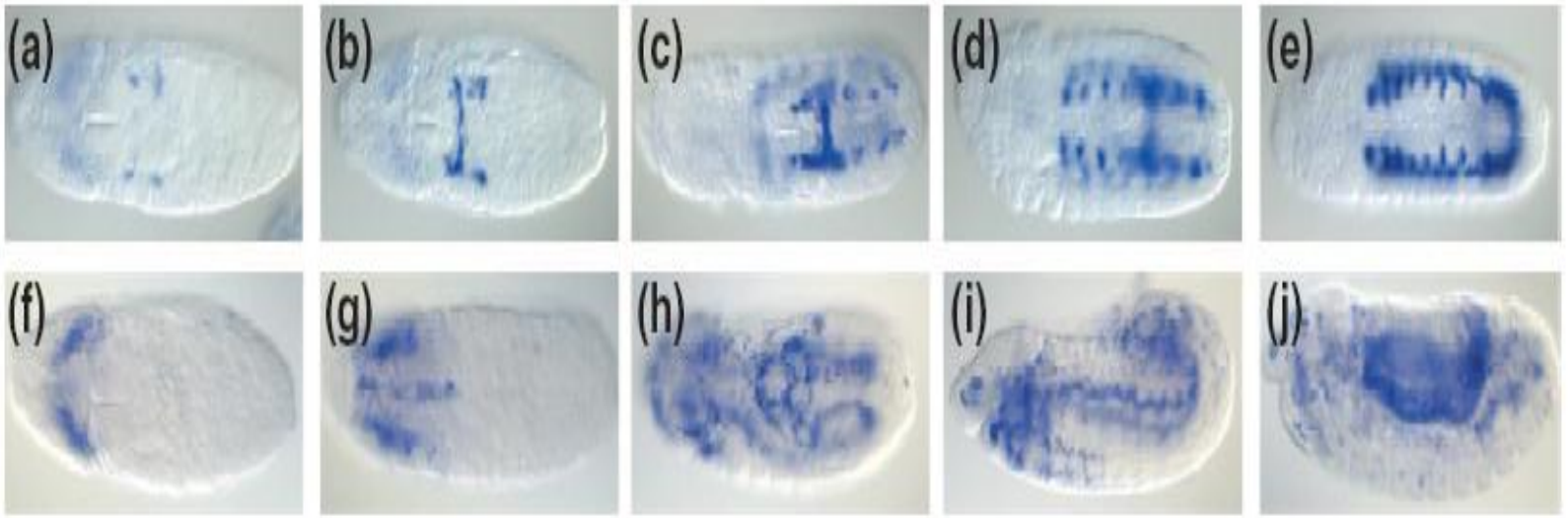
- Spatial-temporal view of expression patterns



(a-e) Series of five embryos stained with a probe (*bgm*)
(f-j) Series of five embryos stained with a probe (*CG4829*)

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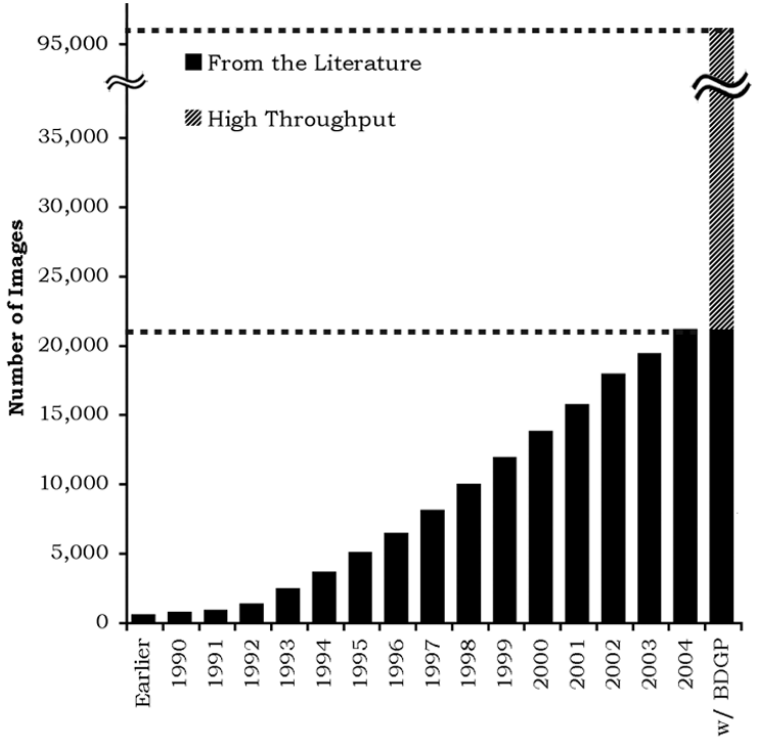
With the increased availability of expression images, the challenge is how to fully utilize them to:

- find other genes with overlapping or complementary patterns of gene expression.
- infer developmental pathways
- understand how regulation of concurrent and sequential gene expression patterns leads to the development of embryos and adult structures.



Number of images containing embryonic expression patterns from 1983 – 2004.

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- The computational approach for answering the above questions automatically involves:
  - Image analysis
    - Standardization or size and orientation
    - Registration of corresponding cells and tissues as organism grows and develops
  - Machine learning
  - Informational retrieval
  - Database management