



# A search for a transcriptional “bottleneck” during embryogenesis



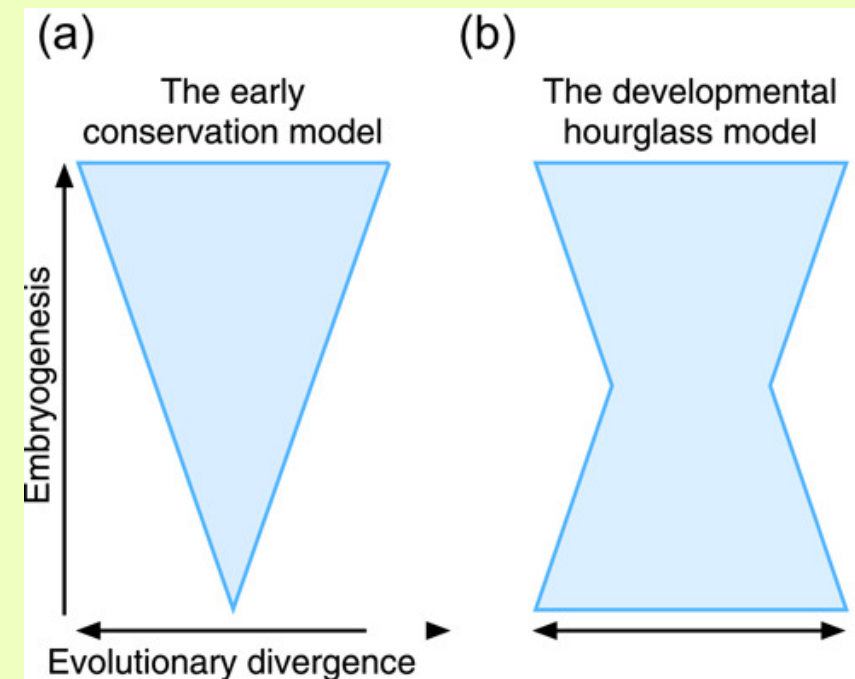
Fyodor Kagakin, Dmitrii Kriukov, Irina Zhegalova

## Conclusion

- We succeeded in identifying “bottleneck” using TAI;
- use of dispersion and phylostratas' average has given controversial results;
- We need to do more studies on this topic;)))

## Introduction

Current hourglass model [2, 3] postulates that there is a “bottleneck” moment, when embryos of different organisms have similarities both on morphological and transcriptomic levels

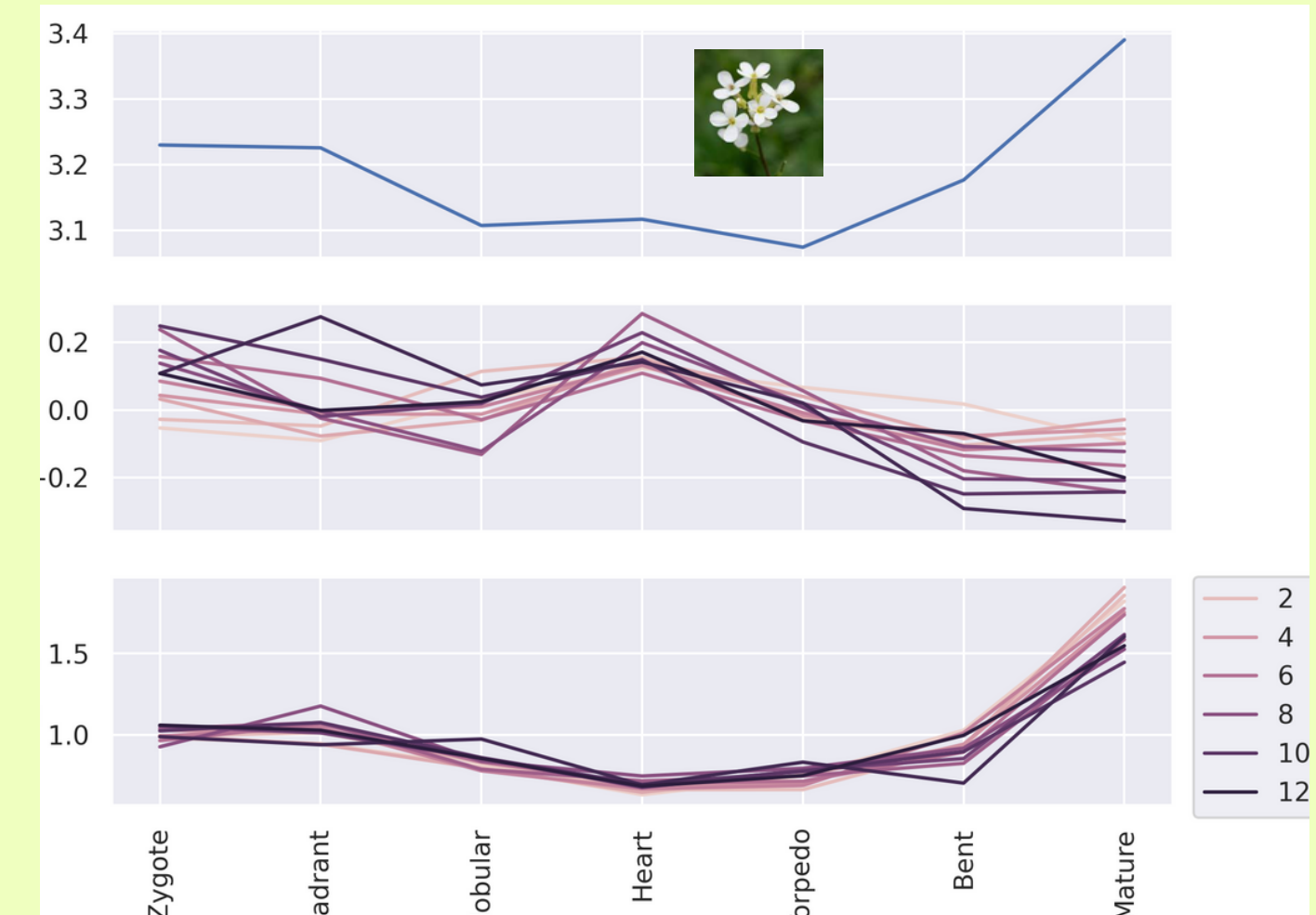
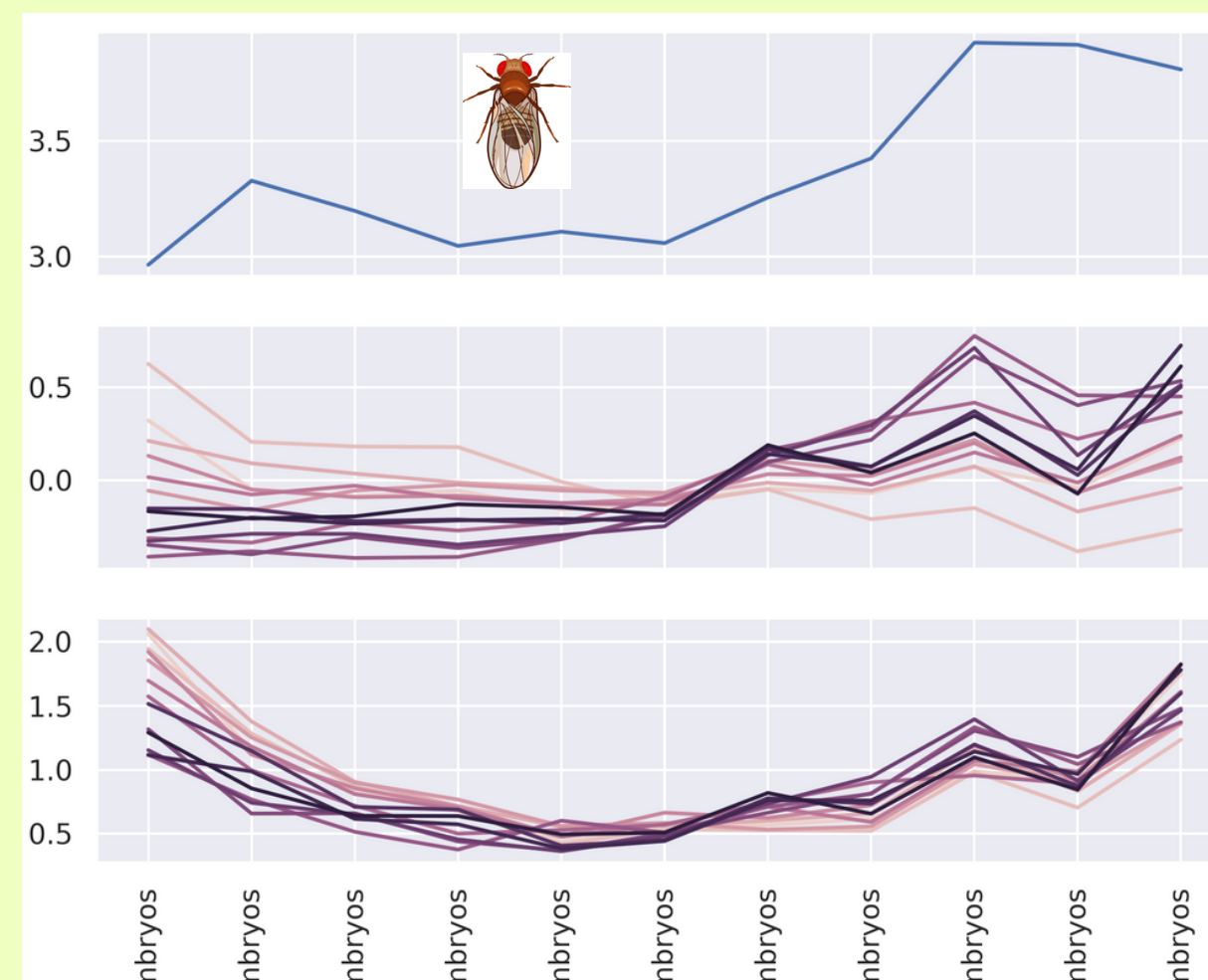
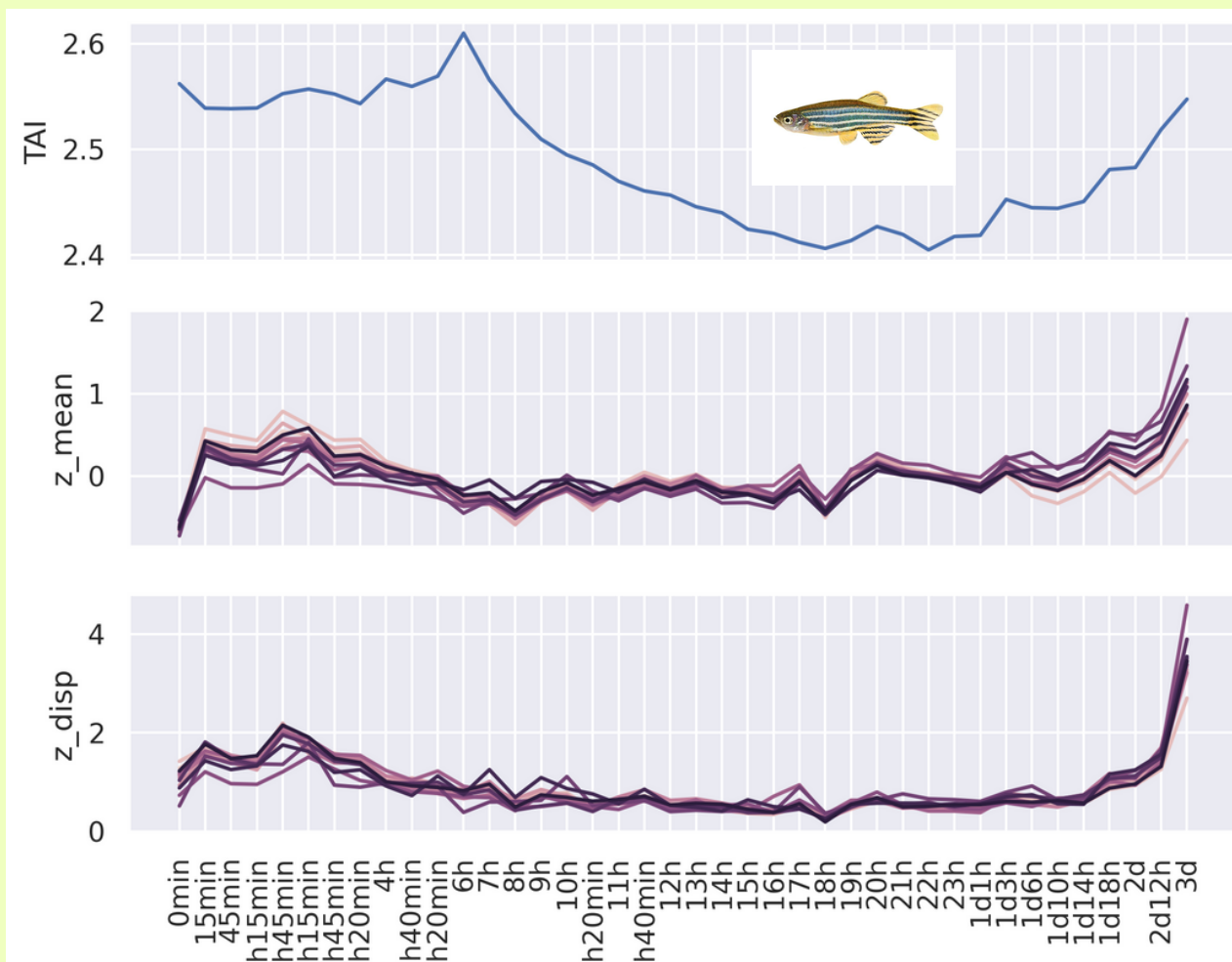


## Hypothesis

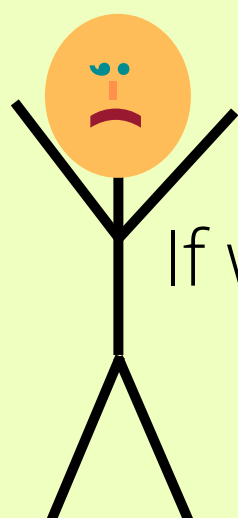
gene expression levels which belong to the different phylostrata and their dispersion confirm the existence of the transcriptional “bottle-neck”

## Data

1. Gene expression and gene age data for *D. rerio*, *D. melanogaster*, *A. thaliana* [1];
2. GSE44183 from the paper [4] - scRNA-seq for embryos of *H. sapiens* at 6-12 days.



$$TAI_s = \frac{\sum_{i=1}^n p s_i e_{is}}{\sum_{i=1}^n e_{is}}$$



If we had more time, we would perform analysis of sc-human data .....

1. Drost, Hajk-Georg, et al. "Evidence for active maintenance of phylotranscriptomic hourglass patterns in animal and plant embryogenesis." *Molecular biology and evolution* 32.5 (2015): 1221-1231.
2. Haeckel, Ernst. *Generelle Morphologie der Organismen. Allgemeine Grundzüge der organischen Formen-Wissenschaft, mechanisch begründet durch die von C. Darwin reformirte Descendenz-Theorie*, etc. Vol. 1. 1866.
3. Uesaka, Masahiro, Shigeru Kuratani, and Naoki Irie. "The developmental hourglass model and recapitulation: An attempt to integrate the two models." *Journal of Experimental Zoology Part B: Molecular and Developmental Evolution* 338.1-2 (2022): 76-86.
4. Xue, Zhigang, et al. "Genetic programs in human and mouse early embryos revealed by single-cell RNA sequencing." *Nature* 500.7464 (2013): 593-597.