

Cellular Programs

Prof. Dr. Volkhard Helms

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Saarland University

Chair of Computational Biology

Assignment 4

Handed out: 18.6.19

Due: 25.6.2019 10:15

Submit your solutions by e-mail with a single PDF attachment to

kerstin.gronow-p@bioinformatik.uni-saarland.de

Every student should submit his/her own solution. Plagiarism of solutions will be penalized. Don't forget to label your assignment sheet with your name and Matrikelnummer.

Don't exceed specified page lengths by more than 0.25 pages.

Problem 1:

Questions to Paper 7: Briggs, J.A. et al. "The dynamics of gene expression in vertebrate embryogenesis at single-cell resolution" *Science* 360, eaar5780 (2018)

Q1. Why is it beneficial to study developmental trajectories at single-cell level? (0.25 page)

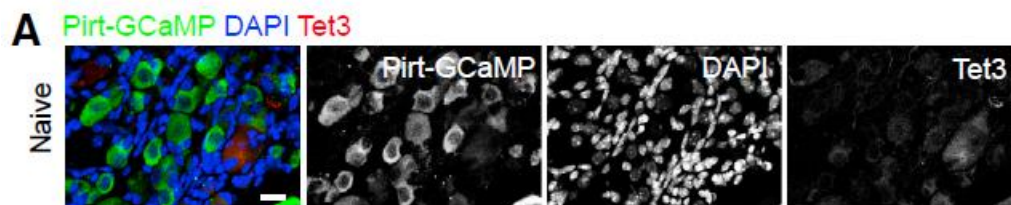
Q2. Fig. 3A shows that "The tail bud and multiple epidermal cell types appeared much earlier than indicated by XAO (Xenbase anatomy ontology)". So the transcriptional program in the involved cells and the anatomical appearance of the organism seem to be out of sync. Which organ/cell/molecule is in charge of the cell identities? Explain your answer (0,5 page max).

Q3. The authors aligned the cell state trees of the Western claw-toed frog and zebrafish and observed that, while the lineage topologies were broadly conserved between species, the proportion of matched states and cells decreased over time as species-specific features accumulated. Briefly explain why this might be the case (0,25 page max).

Problem 2:

Questions to Paper 8: Weng, Y.L. et al. "An Intrinsic Epigenetic Barrier for Functional Axon Regeneration" *Neuron* 94, 337-346.e6 (2017)

Q1. Explain the relationship of the 4 panels in the top row of Fig. 1A (1-2 sentences suffice)



Q2. Which neurons can be regenerated according to existing knowledge? (1 sentence suffices)

Q3. The last sentence of the paper suggests that this study may have "broad implications for regenerative medicine". Imagine that a 40-year old man suffered from a spinal cord injury in a ski accident which paralyzed his legs. Describe a treatment protocol how this patient may be treated successfully in a leading hospital of the future (0,25-0,5 page)