Project Closing Report

OTKA PD-115534

I. Analysis of the role of Hdc in blood cell differentiation

Aims of the work

In our previous work, we isolated Hdc, a factor expressed in the lymph gland. As we found lamellocyte differentiation in our newly isolated *hdc* enhancer trap mutant (*hdc^{19}-Gal4*), we speculated that Hdc may regulate blood cell differentiation in the lymph gland. The aim of our work was to understand the function of Hdc in the regulation of hematopoiesis, and to isolate its potential interacting partners.

Generation of hdc mutants

To isolate amorphic *hdc* alleles, we remobilized the P element located upstream from the promoter of the gene. We tested the candidates with an independent *hdc* allele (*hdc^{31}-Gal4*). In this screen, we isolated 13 *hdc* alleles which were lethal together with *hdc^{31}-Gal4*. We also isolated 27 hypomorphic alleles of the *hdc* gene. We generated stocks from mutant alleles that were lethal or showed a strong phenotype with *hdc^{31}-Gal4*. We designed primers, and used PCR to check the presence of the promoter ATG of the *hdc* gene in the isolated mutant alleles, and found that the ATG was absent only in one of the mutants, which we termed *hdc$^{\Delta 84}$*.

hdc$^{\Delta 84}$ was also lethal in combination with *hdc^{19}-Gal4* and *hdc^{43}*, a poorly characterized *hdc* null allele. We performed further PCR reactions to fine map the deletion in the *hdc$^{\Delta 84}$* mutant allele. During these experiments, it turned out that not only the ATG, but also a large part of the first exon of the gene were missing in the mutant allele. The deletion in *hdc$^{\Delta 84}$* spans 1014 bps upstream and 971 bps downstream from the ATG. Expression of *UAS-hdc* with the *hdc^{19}-Gal4* driver resulted in the rescue of the lethal phenotype of *hdc^{19}-Gal4/hdc$^{\Delta 84}$*.

Expression pattern and phenotype of hdc

As we previously observed that *hdc* is active in the lymph gland, we investigated whether *hdc* is activated outside of the lymph gland any time during the development of the embryo. For this, we monitored the development of *hdc>GFP* and *hdc* cell lineage traced embryos with confocal microscopy. We did not observe *hdc>GFP* expression in any hemocytes in the sessile tissue or the circulation, which indicates that the gene is active exclusively in the lymph gland.

Contrary to this, in our previous experiments, we found that silencing of *hdc* with a general plasmatocyte driver (*Hml-Gal4*) resulted in the dramatic decrease in the number of GFP expressing hemocytes in the sessile tissue. We excluded that this phenomenon is a result of a possible competition between *UAS-GFP* and *UAS-hdcRNAi* transgenes. To investigate whether Hdc is

involved in the regulation of the *Hml* promoter, we studied the effect $hdc^{\Delta 84}$ exerts on the structure of the sessile tissue. We observed no alteration in the number of GFP expressing sessile hemocytes in *Hml>GFP;* $hdc^{\Delta 84}$ larvae compared to the *Hml>GFP* control with confocal microscopy, which indicates that the previously observed phenomenon is due to the off-target effects of the *hdc* silencing.

Using the hdc^{19}*-Gal4* driver, we monitored the expression of *hdc>GFP* in the lymph gland throughout larval development. In second instar larvae, *hdc* was expressed in all functional zones of the primary lobes of the lymph gland. *hdc* expression overlapped with Col staining in the PSC, as well as in the secondary lymph gland lobes (Fig. 1A). During later development, the expression pattern greatly reduced in the primary lymph gland lobes. In third instar larvae, we detected no *hdc* expression in the PSC, however *hdc>GFP* was still detectable in a subset of cells in the secondary lobes of the lymph gland.

Investigation of the larval circulation revealed that lamellocytes differentiate spontaneously without immune induction in $hdc^{\Delta 84}$ larvae (Fig. 1B). We found a similar phenotype in case of the amorphic hdc^{43} allele. In parallel, we found that hdc^{19}*-Gal4*, as well as the amorphic $hdc^{\Delta 84}$ and hdc^{43} reduced the proportion of plasmatocytes in the circulation, which is most likely the result of the appearance of lamellocytes.

The above results corroborated our previous findings that Hdc plays a role in the regulation of hematopoiesis in the lymph gland. As previous results based on silencing *hdc* with various drivers suggested that Hdc is required in the PSC of the lymph gland, we performed an experiment, in which we could rescue the hematopoietic phenotype of hdc^{43} mutation with PSC specific overexpression of *hdc*. This underlined the finding that Hdc acts as a regulator in the PSC, the hematopoietic niche of the lymph gland.

The role of Hdc in the PSC of the lymph gland

We investigated whether Hdc exerts its effect on hematopoiesis via the modulation of the size of the PSC. We found that the number of cells in the PSC and the expression of Col, a PSC cell fate determinant protein is similar to the control in both $hdc^{\Delta 84}$ and hdc^{43} larvae, which indicates that the phenotype of *hdc* is not due to the size of the niche or to the altered identity of the PSC cells.

Therefore, we concluded that Hdc may exert its effect via the interaction with the signalization pathways in the PSC cells. To identify the potential interactors of Hdc, we conducted a candidate genetic screen. In this screen, we overexpressed and silenced the members of previously identified signaling components (*UAS-hepRNAi, UAS-HopRNAi, UAS-*ci^{cell}*, UAS-Ihog, UAS-hh, EP(Ihog), UAS-dpp*, *UAS-Alk*) of the niche in *hdc* silenced larvae with the PSC specific *col-Gal4* driver. We found that overexpression of the Hh pathway components (*Ihog, hh,* ci^{cell}) and also Dpp (*UAS-dpp*) suppressed the lamellocyte phenotype caused by *hdc* silencing. This indicates that *hdc* acts epistatically over *hh* and *dpp* in the PSC of the lymph gland. This is in line with the finding that Dpp signaling maintains niche dependent hematopoietic stem cells (HSCs) in first instar larvae,

while in later stages, Hh signaling is required for the maintenance of hemocyte precursors. We observed similar suppression of the hematopoietic phenotype of *hdc* when the JAK/STAT pathway was blocked (*HopRNAi*). However, blocking the Jun pathway (*hepRNAi*) did not affect the phenotype.

It was unexpected that the silencing of JAK suppressed the *hdc* phenotype, since the regulatory role of the JAK/STAT in the PSC is so far unknown. Therefore, we investigated the effect of PSC specific silencing of *hdc* on the expression pattern of STAT-GFP in the lymph gland. We observed STAT-GFP expression in the PSC of control larvae, which was not affected in *hdc* silenced larvae, but we did not observe STAT-GFP expression in any other zones of the lobe. These results are confusing, therefore further experiments are necessary to clarify the role of JAK/STAT signaling in the PSC of the lymph gland.

Taken together, our results suggest that Hdc plays an important role in the regulation of lamellocyte differentiation via the interaction with the Hh and Dpp signaling pathways in the PSC of the lymph gland (Fig. 1C).

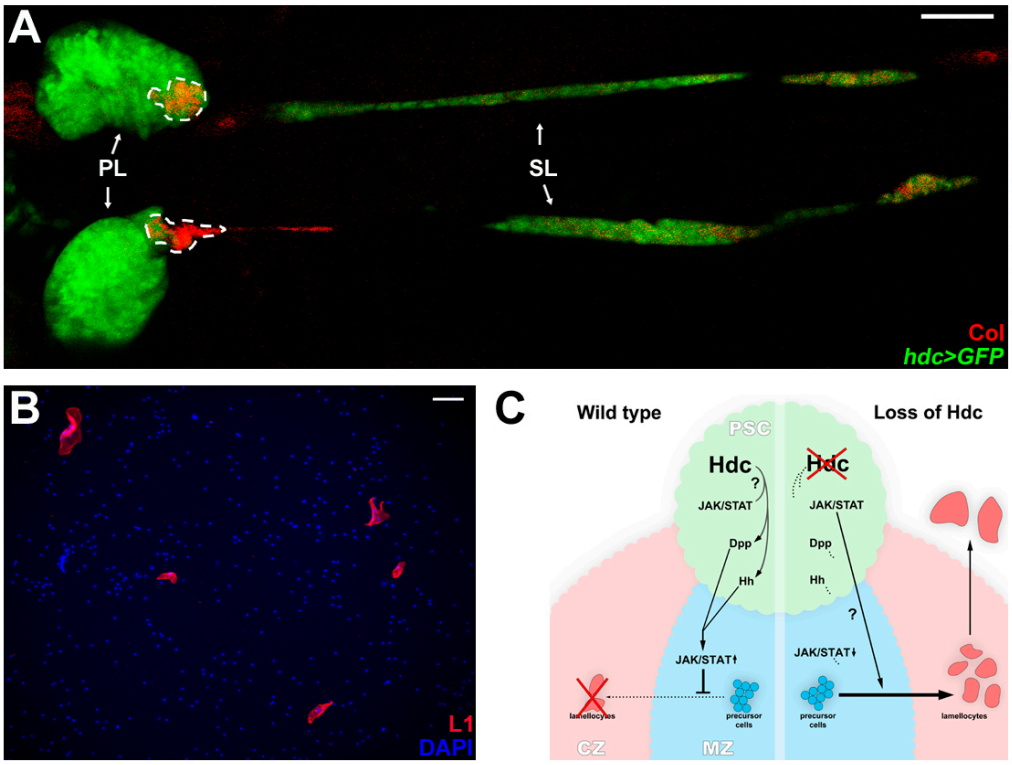

Figure 1. *hdc* expression, phenotype and model of action

(A) The expression of *hdc>GFP* (green) overlaps with anti-Collier staining (red) in the lymph gland in second and early third instar larvae. The PSC is stained specifically with anti-Collier antibody (red). Arrows indicate the primary lobes (PL) and secondary lobes (SL) of the lymph gland. **(B)** Lamellocytes (red) differentiate spontaneously in larvae homozygous for the amorphic $hdc^{\Delta 84}$ allele. **(C)** The results of our genetic interaction screen suggest that Hdc exerts its effect in the PSC of the lymph gland via the Dpp and Hh signaling pathways, which maintain the prohemocyte state of the medullary zone precursors. In *hdc* mutant larvae, the differentiation block of prohemocytes is released, which result in the appearance and release of lamellocytes. Scalebars: 25 µm.

Continuation of the project

As we plan to identify the interacting partners of Hdc, we performed a pilot experiment, in which we used a 3xHA tagged Hdc containing transgenic construct to overexpress *hdc* and to isolate Hdc containing protein complexes on an HA-binding column. In this experiment, it turned out that the construct, which we acquired from a stock center, contains only the predicted but so far uncharacterized isoform B of *hdc*. We identified the potentially interacting proteins with MS analysis. We would like to perform an interaction screen to identify the potential interacting partners of Hdc in the future, however, for this, it is essential to generate a construct that codes for the full-length Hdc protein.

We plan to determine the functional parts of Hdc protein, as well as to perform genetic and molecular interaction studies to identify the regulatory events in which Hdc is involved. These studies will be possible due to the OTKA K-131484 grant, which has already gained support, and which is a direct continuation of OTKA PD-115534.

Publications and PhD thesis based on the results of the project

The results of the project were published in "Varga GIB, Csordás G, Cinege G, Jankovics F, Sinka R, Kurucz É, Andó I, Honti V. Headcase is a Repressor of Lamellocyte Fate in *Drosophila melanogaster*. Genes (Basel). 2019 10(3): E173.", of which I am a joint corresponding author, and which also served as a basis for the already defended PhD thesis of the student's under my supervison, Gergely István Varga. The results of the project were also presented as oral and poster presentations at several national and international conferences.

II. Analysis of the regulation of blood cell differentiation in the sessile tissue and in the circulation

Aims of the work

In this part of the proposal, the aim of the work was to identify factors that regulate the structure and function of the sessile tissue either in a cell-autonomous or non-cell-autonomous manner. We designed our experiments to better understand the effect of immune induction on sessile tissue integrity and on the differentiation of lamellocytes.

Formation of the sessile tissue in the embryo

To investigate the formation of the sessile tissue and to identify the hemocyte subsets that play a role in this process, we performed confocal video microscopy on live transgenic embryos that carried various hemocyte specific drivers (*Hml-GAL4, He-GAL4, eater-GAL4, Pxn-GAL4, gcm-GAL4, crq-GAL4, srp-GAL4, lz-GAL4*). We selected drivers that enabled monitoring hemocytes

from the early embryo to the larva. We found that *Peroxidasin-GAL4* (*Pxn-GAL4*) and *lozenge-GAL4* (*lz-GAL4*) are suitable for following plasmatocytes and crystal cells, respectively.

Using the *Pxn-GAL4* driver, we observed that the sessile is formed in the late embryo by the immobilization of embryonic macrophages in the sessile islets. During this process, the migrating macrophages join the islets in each segment, and stop moving. We observed that the *lz-GAL4* driver becomes active in the already formed sessile islets. This observation implies that the crystal cells do not migrate, but most likely differentiate from macrophages already settled inside each islet.

We performed confocal video microscopy analysis to identify the factors that play a role in the formation of the sessile tissue. After generating the necessary fly stocks for further work, we investigated the effect of the overexpression of *chn* and the mutation of *eater*, *hdc* and $l(3)mbn^{1}$ on the crystal cells, as well as the effect of the hop^{Tum} mutation and the overexpression of *chn* on plasmatocytes. We found no significant effect of the investigated factors on the formation of the sessile tissue. In eater mutant larvae, the sessile tissue formation was similar to that of the wild type control, however, the sessile islets became unstable when the developing larva started to move. This suggests that Eater is not a regulatory factor responsible for the maintenance of the sessile tissue, but plays a role in the attachment of the sessile hemocytes to the body wall.

Structural and dynamic studies of the sessile tissue in the larva

According to previous theories and observations, similarly to the lymph gland, the structure of the sessile tissue disintegrates upon immune induction. To monitor the dynamics of this process, we studied the sessile tissue of parasitized larvae 24 h and 48 h after infestation with confocal video microscopy. We were surprised to observe that, although the larvae contained melanotic nodules and lamellocytes, most of the sessile islets remained stable. We repeated the experiment by inducing the larvae using mechanical wounding instead of the egg-laying of the parasitic wasp, and included two new time points (30 min and 2 h following the induction). We labeled the sessile tissue with the *Hml>GFP* transgenic construct, and also marked individual islets with *in vivo* photoconversion (*Hml-Gal4, UAS-GFP/UAS-EOS; Hml-Gal4, UAS-GFP/UAS-EOS*). We also performed a time-lapse study of the events of the first 2 h following wounding by monitoring the sessile tissue of the larvae every 10 min after immune induction. However, we did not observe major changes in the structure of the sessile tissue.

To further improve the precision of the study, we performed *in vivo* video microscopy on the sessile tissue structure under controlled conditions. We took video footages of a posterior sessile islet of the immune induced larvae (24 h and 48 h following immune induction), and analyzed the displacement and velocity of sessile hemocytes statistically. To achieve this, we developed a novel method with our collaborating partners (József Mihály and Szilárd Szikora; Laboratory of Actin Cytoskeleton Regulation, BRC, Szeged), which enabled the recognition and following of individual hemocytes by the ImageJ software (Fig. 2A). We could not detect any significant differences in the displacement or the velocity of hemocytes of immune induced larvae at any time point following

induction as compared to control uninduced larvae (Fig. 2B,C). The size of the individual islets was also similar in the wounded larvae compared to the control (Fig. 2D).

We also investigated the sessile islets of two tumorous mutants, *hop*^{Tum} and *l(3)mbn*^{1}, and found that, similarly to what was observed in case of immune induction, the presence of melanotic nodules and lamellocytes in these larvae did not affect sessile tissue integrity.

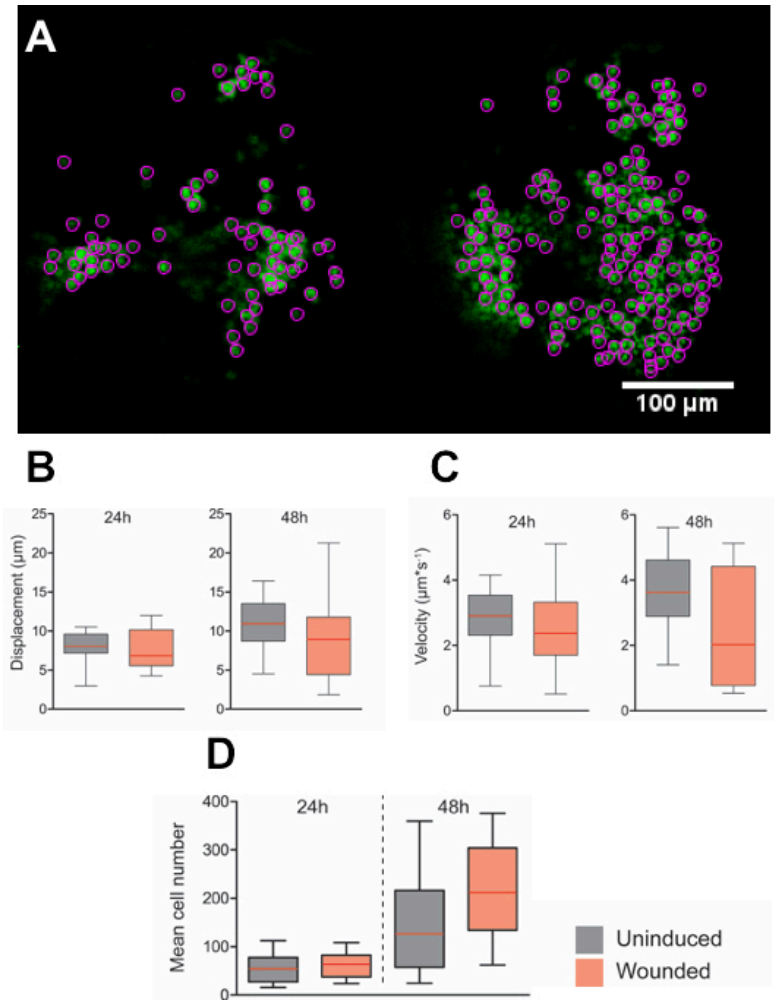

Figure 2. Hemocyte dynamics in the sessile tissue after wounding

(A) An ImageJ base algorithm recognizes individual hemocytes and enables the monitoring of hemocyte dynamics. **(B)** Displacement of hemocytes in unwounded and wounded larvae 24 and 48 h after immune induction. **(C)** Velocity of hemocytes in the sessile islets in unwounded and wounded larvae 24 and 48 h after immune induction. **(D)** Mean cell number of hemocytes in individual sessile islets in unwounded and wounded larvae 24 and 48 h after immune induction. Scalebar: 100 µm.

Analysis of the communication of hematopietic compartments and the function of Pvr/Pvf

To study the intercompartmental communication of the hematopoietic tissues of the larva, we generated lines (*col-Gal4; HmldsRed*, and *col-Gal4; msnCherry*) that enabled the detection of the effect of PSC specific silencing and overexpression of regulatory factors on the sessile tissue structure and on the differentiation of lamellocytes.

Using these lines in a candidate screen, we isolated Pvr, the overexpression of which led to massive lamellocyte differentiation and melanotic nodule formation. We investigated the effect of overexpressing the constitutively active form of Pvr (*UAS-Pvrλ*) on the structure and dynamics of the sessile tissue. The overexpression of Pvr significantly increased the dynamics of the sessile hemocytes, which suggests that Pvr/Pvf signalization may play a role in the regulation of sessile tissue integrity and function (Fig. 3A-E).

Overexpression of the active form of Pvr with the *crq* diver, which is active in the sessile tissue but not in the lymph gland also increased hemocyte dynamics in the sessile islets, suggesting that Pvr can act in a compartment autonomous manner in the sessile tissue. This compartment autonomous effect of Pvr is also underlined by the finding that these larvae - similarly to those in which Pvr was overexpressed in the lymph gland - contained melanotic nodules. Although Pvr/Pvf was found to regulate hematopoiesis in the lymph gland, the role of this signalization was unknown in the sessile tissue.

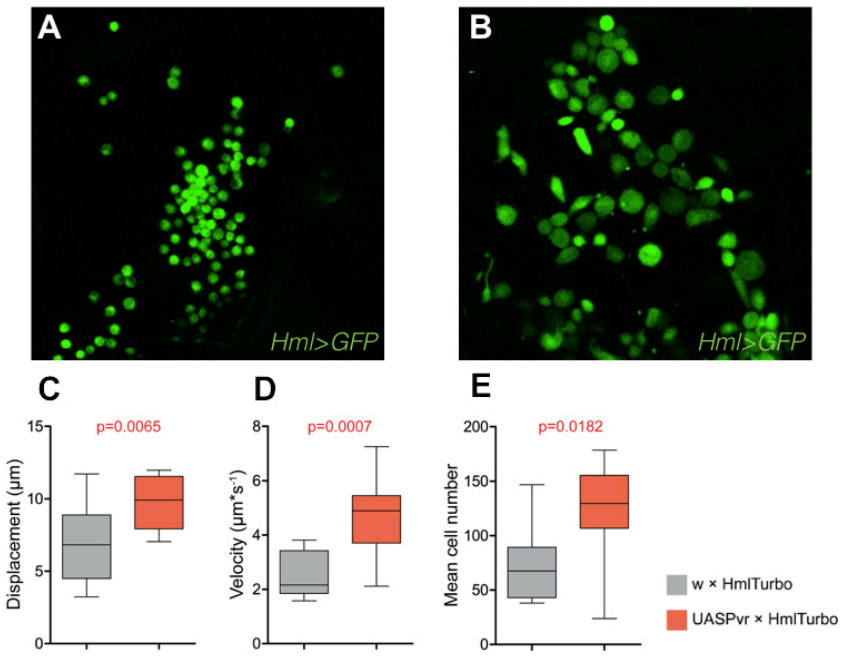

Figure 3. Hemocyte dynamics in the sessile tissue of *Hml>UAS-Pvrλ* larvae

(A) A sessile islet of *a Hml>GFP* larva. **(B)** The number of hemocytes is apparently higher in *Hml>UAS-Pvrλ* larvae as compared to the control. Morphological alterations of hemocytes are also observable as compared to the control. **(C)** Displacement of hemocytes is significantly higher in *Hml>UAS-Pvrλ* larvae as compared to the control. **(D)** Velocity of sesssile hemocytes is significantly higher in *Hml>UAS-Pvrλ* larvae as compared to the control. **(E)** Mean cell number of hemocytes in individual sessile islets is higher in *Hml>UAS-Pvrλ* larvae as compared to the control.

The effect of kynurenine pathway mutations on the sessile tissue

In collaboration with Professor László Vécsei (Department of Neurology, University of Szeged), we investigated the effect of mutants in the kynurenine biosynthesis on the differentiation of hemocytes in *Drosophila*. The study was initiated by the finding that kynurenine plays a role in the regualtion of immune cells in mammals.

We examined the effect of the mutation in three genes encoding enzymes in the kynurenine biosynthesis pathway: *vermilion*, *cardinal* and *cinnabar*, and found that all three mutations led to spontaneous differentiation of lamellocytes in the larva. We observed the appearance of melanotic nodules in the *cinnabar; cardinal* double mutants. The number of lamellocytes were also significantly higher in the double mutants, which indicates a genetic interaction between *cinnabar* and *cardinal*. We did not observe any significant difference in the sessile tissue integrity of the double mutant larvae as compared to the control.

This work served as a basis for Zoltán Koós's BSc diploma work. Zoltán Koós defended his BSc thesis under my supervision.

Analysis of non-cell autonomous blood cell differentiation in the sessile tissue

We adopted a modern method, based on clone analysis involving double lineage tracing (CoinFLP) to isolate factors that regulate sessile tissue integrity and function (Fig. 4A). This method not only enabled the identification of regulatory factors, but also to determine whether these regulators act in a cell-autonomous or non-cell-autonomous manner. To apply the method for hemocytes, we generated hemocyte specific FLP transgenes (*Hemolectin-FLP* and *serpent-FLP*), injected them into embryos, and established stocks from the transgenic flies. Of the generated transgenic lines we selected a *Hml-FLP* line, which labelled the highest number of hemocytes in the larvae (Fig. 4B). We generated a fly stock homozygous for both the *Hml-FLP* and the CoinFLP components, and used this in a candidate screen to silence or overexpress signaling pathway components.

Based on the factors identified in the screen, we concluded that the Pvf/Pvr, the wg, the JUN and the EGF signalization play the major role in the regulation of sessile tissue integrity and function (Fig. 5). We also observed that *UAS-Pvrλ* (the constively active form of Pvr) acts in a cell-autonomous manner, while *UAS-wnt5RNAi* and *UAS-spi* act in a non-cell autonomous manner. This is in line with our current knowledge that Pvr functions as a receptor, while Wnt5 and Spi act as ligands in the described signalization pathways.

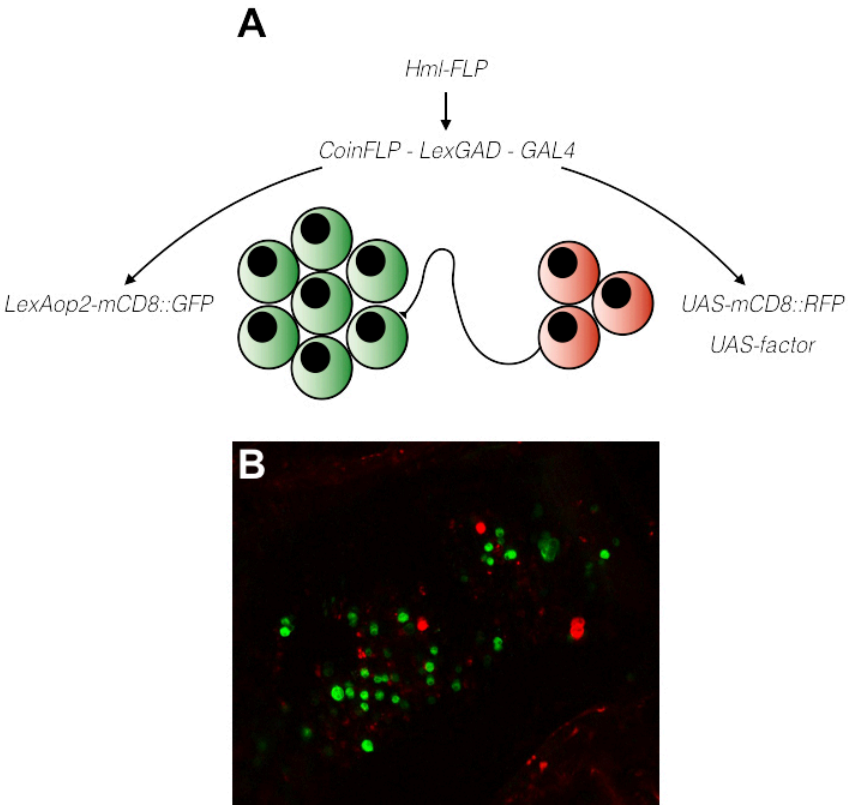

Figure 4. CoinFLP labeling of sessile hemocytes

(A) Double lineage tracing enables the analysis of cell-autonomous and non-cell autonomous hemocyte differentiation. **(B)** Sessile hemocyte clones induced by the newly generated *Hml-FLP*. No overlapping of green and red clones was observed.

These experiments suggest that most of the sessile hemocytes differentiate into lamellocytes in the circulation, after leaving the sessile tissue (Fig. 5). Which also implies that unlike the lymph gland, the sessile tissue is not a real hemocyte niche, and its structure and function are regulated by genetically distinct factors.

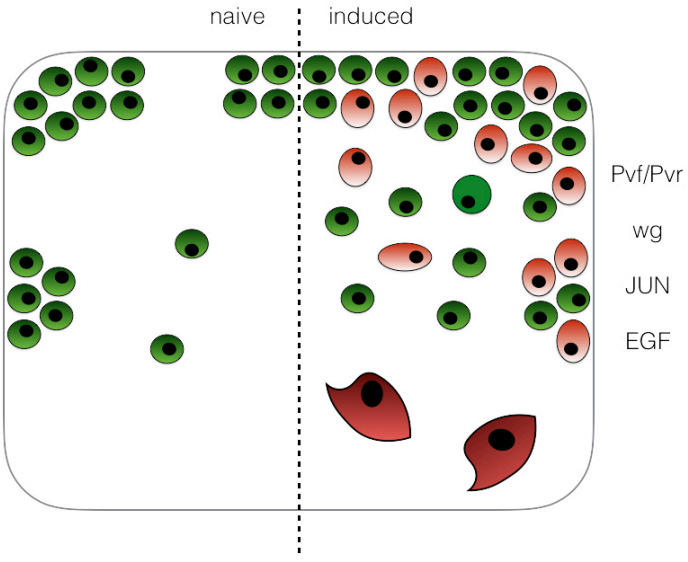

Figure 5. Summary of the candidate screen performed with the CoinFLP system

Our results suggest that the sessile tissue is in dynamic steady-state with the circulation. Lamellocyte differentiation takes place mostly in the circulation from plasmatocytes when they leave the sessile tissue following immune induction. The potential signal transduction pathways that regulate sessile tissue integrity and function based on the result of our screen are listed in the figure.

Machine learning analysis of blood cell differentiation in the circulation

For the investigation of the transdifferentiation of circulating plasmatocytes, we developed an *ex vivo* hemocyte culturing method. In this, we wounded larvae with an insect pin, and isolated hemolymph at different times following the immune induction. We cultured hemocytes on a special slide, on which hemocytes were able to differentiate into lamellocytes. A 24 h long time lapse footage was taken of the differentiation process. The transdifferentiation was monitored by the expression of the plasmatocyte specific *eater-GFP* and the lamellocyte specific *msn-mCherry* transgenes (Fig. 6A).

To follow the differentiation of several thousands of cells, we started a collaboration with Péter Horváth's group, including Ede Migh and Attila Beleon (Laboratory of Microscopic Image Analysis and Machine Learning, BRC, Szeged), to apply a machine learning approach (ACC; Advanced Cell Classifier) to analyze the images taken during hemocyte differentiation. This method involves manual annotation of the hemocytes, which is followed by generating a training set of cell types, which is used as a reference by the algorithm. After this, the software is capable of recognizing hemocytes and rendering them in a regression plane (Fig. 6B), which serves as a basis for the fate mapping.

We found that plasmatocytes isolated from the unwounded control larvae did not differentiate into lamellocytes, which suggests that the transdifferentiation is initiated by signalization processes within the larva. However, a certain portion of the plasmatocytes differentiated into lamellocytes in the immune induced larvae, as detected by the expression of the *msn-mCherry* transgene, and the morphological changes of the cells (Fig. 6A).

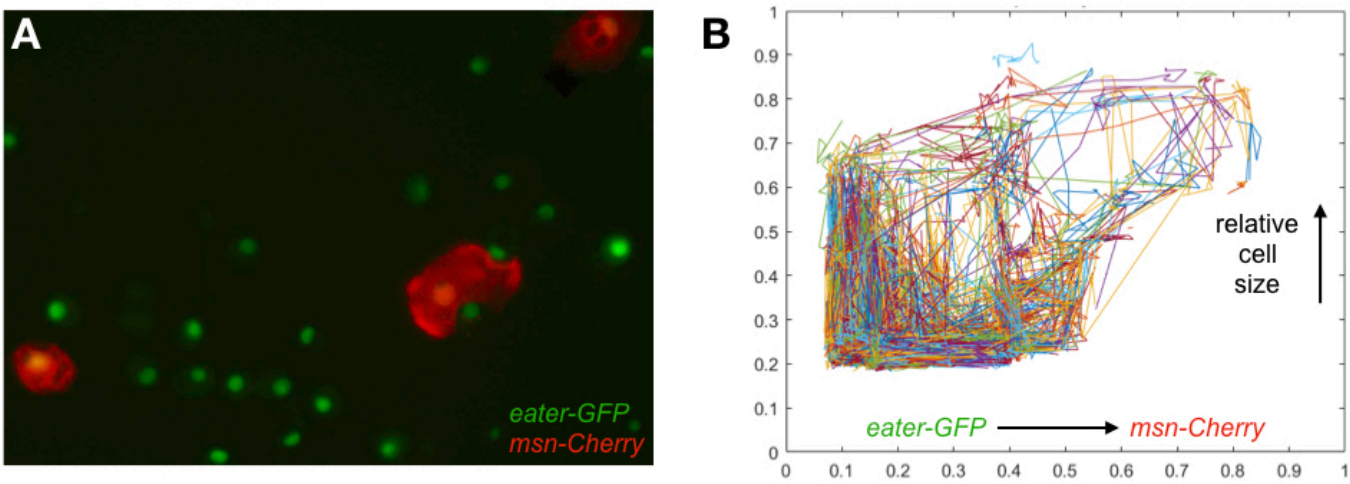

Figure 6. *Ex vivo* transdifferentiation and regression plane of hemocyte fates

(A) *Ex vivo* transdifferentiation of plasmatocytes into lamellocytes. Plasmatocytes (green) transdifferentiate into lamellocytes (red) in less than 24 hours. **(B)** Regression plane of hemocyte transdifferentiation, based on the images of more than 2000 hemocytes over 24 hours. After the manual annotation of the cells, the software is capable of recognizing hemocytes and rendering them in a regression plane, which serves as a basis for the fate map.

Publications and continuation of the project

The results of this project were presented as oral and poster presentations at national and international conferences (listed below). The results also served as a basis for the OTKA K-131484 grant, which has already gained support.

Activity related to the research

- Zoltán Koós prepared and defended his BSc diploma work under my supervision.
- Gergely István Varga defended his PhD thesis under my supervision.
- I organized the Immunity section of the 48. Membrane Transport Conference (Sümeg, 2018).

Publications

Kari B, Csordás G, Honti V, Cinege G, Williams MJ, Andó I, Kurucz É. The raspberry Gene Is Involved in the Regulation of the Cellular Immune Response in Drosophila melanogaster. PLoS One. 2016 Mar 4;11(3):e0150910.

Cinege G, Zsámboki J, Vidal-Quadras M, Uv A, Csordás G, Honti V, Gábor E, Hegedűs Z, Varga GIB, Kovács AL, Juhász G, Williams MJ, Andó I, Kurucz É. Genes encoding cuticular proteins are components of the Nimrod gene cluster in Drosophila. Insect Biochem Mol Biol. 2017 Aug;87:45-54.

Varga GIB, Csordás G, Cinege G, Jankovics F, Sinka R, Kurucz É, Andó I, Honti V. Headcase is a Repressor of Lamellocyte Fate in Drosophila melanogaster. Genes (Basel). 2019 10(3): E173.

Conference talks

2015. 44. Conference of the Hungarian Society for Immunology, Velence

Viktor Honti, Gergely István Varga, Gábor Csordás, Róbert Márkus, Ferenc Jankovics, Éva Kurucz, István Andó: Sessile tissue: a dynamic hematopoietic compartment in *Drosophila melanogaster*

2015. 24th European Drosophila Research Conference, Heidelberg

Viktor Honti: Comparative analysis of hemocyte differentiation in *Drosophila* species

2016. JEDI (Junior European Drosophila Investigators) 2016 meeting, Visegrád

Viktor Honti: Regulation of sessile tissue integrity and function in *Drosophila melanogaster*

2017. Hungarian Molecular Life Sciences, Eger

Viktor Honti, Gergely István Varga, Gábor Csordás, Róbert Márkus, Ferenc Jankovics, Éva Kurucz and István Andó: Sessile tissue: a dynamic blood cell compartment in *Drosophila melanogaster*

2017. Straub-days, Szeged (BRC, Szeged)

Gergely I.B. Varga, Gábor Csordás, Ferenc Jankovics, Tamás Lukácsovich, Éva Kurucz, Viktor Honti and István Andó: Headcase regulates the hematopoiesis of *Drosophila melanogaster*

2017. 46. Conference of the Hungarian Society for Immunology, Velence

Viktor Honti: Conservation vs. convergent evolution in the regulation of hematopoiesis (Plenary lecture)

2018. 48. Membrane Transport Conference, Sümeg

Honti Viktor, Varga Gergely István, Csordás Gábor, Cinege Gyöngyi, Jankovics Ferenc, Sinka Rita, Szikora Szilárd, Kurucz Éva és Andó István: A sejtek közötti kommunikáció szerepe a *Drosophila melanogaster* vérsejtképző kompartmentumaiban zajló differenciálódás során

2018. New Directions in *Drosophila* Blood Cell Biology, Vienna, Austria

Gergely I. B. Varga, Gábor Csordás, Gyöngyi Cinege, Ferenc Jankovics, Rita Sinka, Éva Kurucz, István Andó * and Viktor Honti *: Headcase regulates blood cell fate via the Hedgehog and Decapentaplegic pathways in *Drosophila melanogaster*

2019. Hungarian Molecular Life Sciences, Eger

Viktor Honti, Gergely István Varga, Gábor Csordás, Róbert Márkus, Gyöngyi Cinege, Szilárd Szikora, Ede Migh, Péter Horváth, Éva Kurucz, István Andó: Analysis of sessile tissue integrity and function in *Drosophila melanogaster*

2019. "Genetikai Műhelyek Magyarországon" XVIII. Miniconference, Szeged

Varga Gergely István†, Migh Ede†, Beleon Attila, Szkalisity Ábel, Hollandi Réka, Horváth Péter, Kurucz Éva, Andó István* és Honti Viktor*: Gépi tanulás alkalmazása az ecetmuslica vérsejt-differenciálódásának vizsgálatában

2019. 48. Conference of the Hungarian Society for Immunology, Bükfürdő

István Gergely Varga†, Ede Migh†, Attila Beleon, Ábel Szkalisity, Réka Hollandi, Péter Horváth, Éva Kurucz, István Andó* and Viktor Honti*: Machine learning analysis of blood cell transdifferentiation in *Drosophila melanogaster*

Conference posters

2016. Straub-days, Szeged (BRC, Szeged)

Gergely I. B. Varga, Gábor Csordás, Ferenc Jankovics, Tamás Lukácsovich, Éva Kurucz, Viktor Honti* and István Andó*: Headcase, a novel regulator of blood cell homeostasis in *Drosophila melanogaster*

2016. 45. Conference of the Hungarian Society for Immunology, Velence

Gergely I. B. Varga, Gábor Csordás, Ferenc Jankovics, Tamás Lukácsovich, Éva Kurucz, Viktor Honti* and István Andó*: Headcase regulates hemocyte differentiation in *Drosophila melanogaster*

2017. Hungarian Molecular Life Sciences, Eger

Gergely I. B. Varga, Gábor Csordás, Ferenc Jankovics, Tamás Lukácsovich, Gyöngyi Cinege, Éva Kurucz, Viktor Honti* and István Andó*: Headcase regulates non-cell-autonomous hemocyte differentiation in *Drosophila melanogaster*

2017. Straub-days, Szeged (BRC, Szeged)

Viktor Honti, Gergely István Varga, Gyöngyi Cinege, Gábor Csordás, Róbert Márkus, Ferenc Jankovics, Szilárd Szikora, Éva Kurucz and István Andó: Analysis of sessile tissue integrity and function in *Drosophila melanogaster*

2018. 48. Membrán Transport Conference, Sümeg

Varga B.I. Gergely, Csordás Gábor, Jankovics Ferenc, Cinege Gyöngyi, Kurucz Éva, Andó István* és Honti Viktor*: A Headcase a *Drosophila* vérsejtképződésének szabályozó faktora

2018. 47. Conference of the Hungarian Society for Immunology, Bükfürdő

Viktor Honti, Gergely István Varga, Gábor Csordás, Szilárd Szikora, Ferenc Jankovics, Éva Kurucz and István Andó: Integrity and function of the sessile tissue in *Drosophila melanogaster*

2018. 47. Conference of the Hungarian Society for Immunology, Bükfürdő

Gergely I. B. Varga, Gábor Csordás, Ferenc Jankovics, Tamás Lukácsovich, Gyöngyi Cinege, Rita Sinka, Éva Kurucz, István Andó* and Viktor Honti*: Headcase, a novel regulator of hemocyte differentiation in *Drosophila melanogaster*

2019. Hungarian Molecular Life Sciences, Eger

Gergely I. B. Varga, Gábor Csordás, Ferenc Jankovics, Gyöngyi Cinege, Rita Sinka, Éva Kurucz, István Andó* and Viktor Honti*: Headcase is a regulator of hemocyte differentiation in *Drosophila melanogaster*

2019. Straub-days, Szeged (BRC, Szeged)

Gergely István Bobek Varga, Gábor Csordás, Ferenc Jankovics, Gyöngyi Cinege, Rita Sinka, Éva Kurucz, István Andó*, Viktor Honti*: Headcase is a regulator of hemocyte differentiation in *Drosophila melanogaster*

Teaching activity, university courses

- I took part in the MSc course organized for English speaking students titled “Scientific Literature Sources” as a lecturer (2015, 2016, 2017, 2018, 2019 “Blood of the Fly”).
- I organized the obligatory course at the Institute of Psychology, University of Szeged in 2015/2016 and 2016/2017 titled “Etológia és magatartásgenetika”.
- I had a lecture in the PhD Journal Club course at the Institute of Genetics, BRC (2016.04.04. “How (not) to write a scientific article”).
- I took part in the course titled “Molekuláris Sejtbiológia” at the University of Szeged (2017, 2018 “Vérsejt differenciálódás”).

Popular science

- We organized a programs for the “Kutatók éjszakája” event titled “Az ecetmuslica és az ember vére” (2015.09.25., 2016.09.30., 2017.09.29., 2018.09.28.).
- I took part in the “Középiskolás Élettudományi Kutatótábor” as a lecturer (2016, 2017, 2018, “Két legyet egy csapásra - az ecetmuslica immunrendszere”).