

POSTER PRESENTATION

Open Access

# Comparing genetic pathways variation of immunoinhibitory receptor LAIR-1 in murine vs human internal organs

Shuqiu Sun<sup>1,2</sup>, Yan Jiao<sup>2</sup>, Wei Wei<sup>1</sup>, Arnold E Postlethwaite<sup>3</sup>, Weikuan Gu<sup>2\*</sup>, Dianjun Sun<sup>1\*</sup>

From UT-KBRIN Bioinformatics Summit 2014  
Cadiz, KY, USA. 11-13 April 2014

## Background

Recent evidence suggests that leukocyte-associated immunoglobulin-like receptor-1 (LAIR-1) may play an important role in down-regulating immune activities upon collagen binding [1], and its defective expression or dysfunction is clinically associated with some autoimmune diseases [2-5], cancer [6-8] and viral infection [9-12]. The human genome encodes the counterpart to LAIR-1, soluble protein LAIR-2 [13], which also binds collagen and can interfere with LAIR-1/collagen interactions [14]. However, LAIR-2 has no homologue in mouse or rat [13]. To clarify the extrapolative credibility of a murine model to human disease, we compared LAIR-1 genetic pathways in internal organs of the two species.

## Materials and methods

### Data source

We used the GeneNetwork software developed by the University of Tennessee, and six eligible datasets of normal liver, lung, and brain tissue from the linked database [15].

### Statistical analysis

The top genes shared by mouse and human on the basis of Pearson correlation, were picked for plotting network graphs in GeneNetwork. An  $r$  absolute value  $>0.50$  was considered to indicate connection line threshold.

## Results

### Significant variation in LAIR-1 genetic pathways was found in mouse vs human internal organs

The top 50 mouse genes by LAIR-1's Pearson correlation were employed to search for the same genes in corresponding human tissue throughout relevant databases. There were 33 common genes found in liver, 32 in lung, and 31 in brain. The network node of LAIR-1 has a more robust connection for mouse than for human, and no common genes except for LAIR-1 were shared by liver, lung and brain in mice or humans. These observations can be confirmed in liver with the common genes of the top 100 human and top 100 mouse LAIR-1 relevant genes.

### Genetic interaction of human LAIR-1 with LAIR-2 *in vivo* rarely occurred

The interaction of LAIR-2 with LAIR-1 only occurred in the top 200 genes for lung tissue with a positive coefficient of 0.426, and in the top 300 genes for brain tissue with a negative coefficient of -0.242, but not for liver tissue, according to Pearson correlation distance and intensity.

## Conclusions

LAIR-1 genetic pathways have noteworthy species difference and tissue specificity, which may cause overestimation if using mouse experimental data to evaluate human conditions. Moreover, human LAIR-1 and LAIR-2 actually get the rare opportunity to interact *in vivo*, implying that species difference in regard to LAIR-1 genetic pathways could not be primarily attributed to the existence of human LAIR-2.

\* Correspondence: wgu@uthsc.edu (WG); hrbmusdj@163.com (DS)

<sup>1</sup>National Center for Endemic Disease Control, Harbin Medical University, Harbin 150081, China

<sup>2</sup>Department of Orthopedic Surgery and BME, University of Tennessee Health Science Center, Memphis, TN 38163, USA

Full list of author information is available at the end of the article

#### Acknowledgements

We are grateful to Dr. Robert Williams for his generosity in providing data in the GeneNetwork for this analysis.

#### Authors' details

<sup>1</sup>National Center for Endemic Disease Control, Harbin Medical University, Harbin 150081, China. <sup>2</sup>Department of Orthopedic Surgery and BME, University of Tennessee Health Science Center, Memphis, TN 38163, USA. <sup>3</sup>Department of Medicine, University of Tennessee Health Science Center, Memphis, TN 38163, USA.

Published: 29 September 2014

#### References

1. Meyaard L, Hurenkamp J, Clevers H, Lanier LL, Phillips JH: **Leukocyte-associated Ig-like receptor-1 functions as an inhibitory receptor on cytotoxic T cells.** *J Immunol* 1999, **162**:5800-5804.
2. Olde Nordkamp MJ, van Roon JA, Douwes M, de Ruiter T, Urbanus RT, Meyaard L: **Enhanced secretion of leukocyte-associated immunoglobulin-like receptor 2 (LAIR-2) and soluble LAIR-1 in rheumatoid arthritis: LAIR-2 is a more efficient antagonist of the LAIR-1-collagen inhibitory interaction than is soluble LAIR-1.** *Arthritis Rheum* 2011, **63**:3749-3757.
3. Colombo BM, Canevali P, Magnani O, Rossi E, Puppo F, Zocchi MR, Poggi A: **Defective expression and function of the leukocyte associated Ig-like receptor 1 in B lymphocytes from systemic lupus erythematosus patients.** *PLoS One* 2012, **7**:e31903.
4. Simone R, Pesce G, Antola P, Merlo DF, Bagnasco M, Saverino D: **Serum LAIR-2 is increased in autoimmune thyroid diseases.** *PLoS One* 2013, **8**: e63282.
5. Son M, Santiago-Schwarz F, Al-Abed Y, Diamond B: **C1q limits dendritic cell differentiation and activation by engaging LAIR-1.** *Proc Natl Acad Sci USA* 2012, **109**:E3160-E3167.
6. Zocchi MR, Pellegatta F, Pierrì I, Gobbi M, Poggi A: **Leukocyte-associated Ig-like receptor-1 prevents granulocyte-monocyte colony stimulating factor-dependent proliferation and Akt1/PKB alpha activation in primary acute myeloid leukemia cells.** *Eur J Immunol* 2001, **31**:3667-3675.
7. Poggi A, Catellani S, Bruzzone A, Caligaris-Cappio F, Gobbi M, Zocchi MR: **Lack of the leukocyte-associated Ig-like receptor-1 expression in high-risk chronic lymphocytic leukaemia results in the absence of a negative signal regulating kinase activation and cell division.** *Leukemia* 2008, **22**:980-988.
8. Rytgiel TP, Stolte EH, de Ruiter T, van de Weijer ML, Meyaard L: **Tumor-expressed collagens can modulate immune cell function through the inhibitory collagen receptor LAIR-1.** *Mol Immunol* 2011, **49**:402-406.
9. Aoukaty A, Lee IF, Wu J, Tan R: **Chronic active Epstein-Barr virus infection associated with low expression of leukocyte-associated immunoglobulin-like receptor-1 (LAIR-1) on natural killer cells.** *J Clin Immunol* 2003, **23**:141-145.
10. De Milito A, Nilsson A, Titanji K, Thorstensson R, Reizenstein E, Narita M, Grutzmeier S, Sönnnerborg A, Chiodi F: **Mechanisms of hypergammaglobulinemia and impaired antigen-specific humoral immunity in HIV-1 infection.** *Blood* 2004, **103**:2180-2186.
11. Titanji K, Chiodi F, Bellocco R, Schepis D, Osorio L, Tassandin C, Tambussi G, Grutzmeier S, Lopalco L, De Milito A: **Primary HIV-1 infection sets the stage for important B lymphocyte dysfunctions.** *AIDS* 2005, **19**:1947-1955.
12. Kennedy PT, Sandalova E, Jo J, Gill U, Ushiro-Lumb I, Tan AT, Naik S, Foster GR, Bertoletti A: **Preserved T-cell function in children and young adults with immune-tolerant chronic hepatitis B.** *Gastroenterology* 2012, **143**:637-645.
13. Lebbink RJ, van den Berg MC, de Ruiter T, Raynal N, van Roon JA, Lenting PJ, Jin B, Meyaard L: **The soluble leukocyte-associated Ig-like receptor (LAIR)-2 antagonizes the collagen/LAIR-1 inhibitory immune interaction.** *J Immunol* 2008, **180**:1662-1669.
14. Lenting PJ, Westerlaken GH, Denis CV, Akkerman JW, Meyaard L: **Efficient inhibition of collagen-induced platelet activation and adhesion by LAIR-2, a soluble Ig-like receptor family member.** *PLoS One* 2010, **5**:e12174.
15. GeneNetwork. [http://www.genenetwork.org/webqtl/main.py].

doi:10.1186/1471-2105-15-S10-P9

**Cite this article as:** Sun *et al.*: Comparing genetic pathways variation of immunoinhibitory receptor LAIR-1 in murine vs human internal organs. *BMC Bioinformatics* 2014 **15**(Suppl 10):P9.

**Submit your next manuscript to BioMed Central and take full advantage of:**

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

Submit your manuscript at  
www.biomedcentral.com/submit

