Soile Vanamo Elisabet Keränen

Lawrence Berkeley National Laboratory, M/S 84R0171
Biological Systems and Engineering
1 Cyclotron Road
Berkeley, CA 94720
USA
Tel: + 1 – 510 – 486 5662
E-mail: svekeranen@lbl.gov

Education

Ph.D. University of Helsinki, 1995 – 2000, evolutionary developmental genetics. Dissertation: "The Developmental Basis for the Evolution of Muroid Dentition: Analysis of gene expression and tooth morphogenesis in the mouse and sibling vole".

M.Sc. University of Helsinki, 1990 - 1995, biology, genetics, (*stipend student in University of Edinburgh, 1993 – 1994*). Thesis: "The Comparison between Particle Bombardment and Lipofection as Methods for Transfecting Genes into Embryonal Mouse Teeth".

Post-graduate employment

09/12/2005 - date: Scientist in the Genomics and Biological Systems and Engineering Divisions, Lawrence Berkeley National Laboratory overseeing *Drosophila* 3D image data production and developing new methods.

06/04/2001 – 09/11/2005: Post-doctoral Fellow, Genomic Division, Lawrence Berkeley National Laboratory developing *Drosophila* 3D image data production and analysis.

11/14/2000 – 05/31/2001: Post-doctoral Fellow, William McGinnis's laboratory, UC San Diego developing methods for analysing the signaling interactions controlling morphogenesis and morphological evolution using *Drosophila* genomic information.

Current memberships

The Finnish Society for Developmental Biology

The Genetics Society of America

The International Society for Computational Biology

Fellowships and awards

Academy of Finland: 2001 – 2002: 341.000 FIM
(~56.800 EUR)

Helsingin Sanomain 100-vuotissäätiö: 2001 – 2003: 160.000 FIM
(~26.700 EUR)

An honorary mention and a recognition prize in a scientific writing competition by Luonnon Tutkija: 1999: 1.000 FIM

Editorial Board Memberships

International Scholarly Research Notices *(current)*

Chinese Journal of Biology *(past)*

Research Projects

1995: M.Sc. research on gene transfection methods for mouse dental primary cell and tissue cultures.

1995 – 2000: Ph.D. research using comparative biology and tissue culture of muroid teeth as a paradigm for pattern formation and morphogenesis. The results of this project demonstrate how similar developmental programs can be utilized to produce different spatial gene expression and tissue growth/differentiation patterns.

2000 – date: Post-graduate research using high throughput gene expression analyses and computer simulations to understand pattern formation in *Drosophila melanogaster* blastoderm and late stage embryos as a paradigm for metazoan developmental complexity, gene regulation and morphological evolution.

2002 – 2004: Post-graduate research using abstract computational modeling to understand the roles of regulatory network structure and function and transregulatory information in the evolution of complexity.

Refereed Publications

1) Fowlkes C.C., Eckenrode K.B., Bragdon M.D., Meyer M., Wunderlich Z., Simirenko L., Luengo Hendriks C.L., Keränen S.V.E., Henriquez C., Knowles D.W., Biggin M.D., Eisen M.B., DePace A.H. (2011) **A conserved developmental patterning network produces quantitatively different output in multiple species of Drosophila.** *PLoS Genetics. 7(10):e1002346.*

2) Aswani A., Keränen S., Brown J., Fowlkes C., Knowles D., Biggin M., Bickel P., Tomlin C. (2010) **Nonparametric Identification of Regulatory Interactions from Spatial and Temporal Gene Expression Data.** *BMC Bioinformatics 11:413.*

3) Rübel O., Weber G.H., Huang M.-Y., Bethel E.W., Biggin M.D., Fowlkes C.C., Luengo Hendriks C.L., Keränen S.V.E., Eisen M.B., Knowles D.W., Malik J., Hagen H., Hamann B. (2010) **Integrating data clustering and visualization for the analysis of 3D gene expression data**. *IEEE/ACM Transactions on Computational Biology and Bioinformatics 7(1):64-79*.

4) MacArthur S., Li X.-Y., Li J., Brown J.B., Chu H.C., Zeng L., Grondona B.P., Hechmer A., Simirenko L., Keränen S.V.E., Knowles D.W., Stapleton Bickel M., P., Biggin M.D., Eisen M.B. (2009) **Developmental roles of 21 Drosophila transcription factors are determined by quantitative differences in binding to an overlapping set of thousands of genomic regions.** *Genome Biology 10(7):R80.*

The 17th most accessed article for past year in Genome Biology (2009), included in F1000 Biology list, Drosophila Image Award 2010 Finalist, Shortlisted for the Genome Biology Award 2009

5) Weber G.H., Rübel O., Huang M.-Y., DePace A.H., Fowlkes C.C., Keränen S.V.E., Luengo Hendriks C.L., Hagen H., Knowles D.W., Malik J., Biggin M.D., Hamann B. (2009) **Visual exploration of three-dimensional gene expression using physical views and linked abstract views.** *IEEE/AMC Transactions on Computational Biology and Bioinformatics 6(2):296-309.*

6) Fowlkes C.C., Luengo Hendriks C.L., Keränen S.V.E., Weber G.H., Rübel O., M.-Y. Huang, Chatoor S., Simirenko L., Henriquez C., Beaton A., Weiszmann R., Celniker S., Eisen M.B., Biggin M.D. (2008**)** **Constructing a quantitative spatio-temporal atlas of gene expression in the *Drosophila* blastoderm.** *Cell 133(2):364-374.*
Commented in Developmental Cell 2008 May;14(5):639-40. and Nature Methods 2008 Jun;5(6):466

7) Luengo Hendriks, C.L., Keränen, S.V.E., Biggin, M.D., Knowles, D.W.K. (2007) **Automatic channel unmixing for high-throughput quantitative analysis of fluorescence images.** *Optics Express* 15(19):12306-12317.

8) Keränen, S.V.E.*, Fowlkes C.C.*, Luengo Hendriks C.L.*, Sudar D., Knowles D.W., Malik J., Biggin M.D. (2006) **Three-dimensional morphology and gene expression in the *Drosophila* blastoderm at cellular resolution II: dynamics.** *Genome Biology* 7(12):R124. * co-equal first authors
Commented in Nature Reviews Genetics 2007 February;8(2):88-89. and American Scientist 2007 January-February 95, Drosophila Image Award 2007 Finalist

9) Luengo Hendriks C.L.*, Keränen S.V.E.*, Fowlkes C.C, Simirenko L., Weber G.H., DePace A.H., Henriquez C., Kaszuba D.W., Hamann B., Eisen M.B., Malik J., Sudar D., Biggin M.D., Knowles D.W. (2006) **Three-dimensional morphology and gene expression in the *Drosophila* blastoderm at cellular resolution I: data acquisition pipeline.** *Genome Biology* 7(12):R123. * co-equal first authors
Commented in Nature Reviews Genetics 2007 February;8(2):88-89. and American Scientist 2007 January-February 95

10) Keränen S.V.E. (2004) **Simulation study on effects of signaling network structure on the developmental increase in complexity.** *Journal of Theoretical Biology 231(1):3-21, Erratum in Journal of Theoretical Biology 242(1):263.*

11) Keränen S.V.E. (2001) **Molekyylit, kehitysbiologia ja muodon evoluutio**. *Luonnon Tutkija 105:10-21.* (review in Finnish)
An honorary mention and a recognition prize in a 1999 scientific writing competition by Luonnon Tutkija

12) Jernvall J., Keränen S.V.E., Thesleff I. (2000) **Evolutionary modification of development in mammalian teeth: Quantifying gene expression patterns and topography.** *Proceedings of the National Academy of Sciences of the United States of America 97(26): 14444-14448.*
Commented in Proceedings of the National Academy of Sciences of the United States of America 97(26):14019-1421.

13) Keränen SVE., Kettunen P., Åberg T., Thesleff I., Jernvall J. (1999) **Gene expression patterns associated with suppression of odontogenesis in mouse and vole diastema regions.** *Development Genes & Evolution 209(8):495-506.*

14) Keränen S.V.E., Åberg T., Kettunen P., Thesleff I., Jernvall J (1998). **Association of developmental regulatory genes with the development of different molar tooth shapes in two species of rodents.** *Development Genes & Evolution 208(9):477-86.*
A journal cover figure in the same issue

15) Jernvall J., Åberg T., Kettunen P., Keränen S., Thesleff I. (1998) **The life history of an embryonic signaling center: BMP-4 induces p21 and is associated with apoptosis in the mouse tooth enamel knot.**

Development 125(2):161-9.

16) Vaahtokari A., Åberg T., Jernvall J., Keränen S., Thesleff I. (1996) **The enamel knot as a signaling center in the developing mouse tooth.** *Mechanisms of Development 54(1):39-43.*

Articles, in non-refereed journals

1) Thesleff I., Keränen S., Jernvall J. (2001) **Enamel knots as signaling centers linking tooth morphogenesis and odontoblast differentiation.** *Advances in Dental Research 15(1):14-18.*

2) Keränen S.V.E. (1998) **Kehitysbiologian ja evoluution uusi synteesi.** *Solubiologi 1:23-29*. (review in Finnish)

Conference publications, technical reports, etc.

1) Barron J.T., Arbeláez P., Keränen S.V.E., Biggin M.D., Knowles D.W., Malik J., (2013) **Volumetric Semantic Segmentation using Pyramid Context Features.** I*n: International Conference on Computer Vision (ICCV), Sydney Australia, 2013, pp. 3448 - 3455.*

2) Rübel, O., Keränen S.V.E., Biggin M.D., Knowles D.W., Weber G.H., Hagen H., Hamann B. Bethel E.W. (2012) **Linking Advanced Visualization and MATLAB for the Analysis of 3D Gene Expression Data.** *In: Hege, H.-C., Linsen L., eds., Mathematics and Visualization, Visualization in Medicine and Life Sciences II, Progress and New Challenges, Springer Verlag, Heidelberg, Germany, 2012, pp 267-285.*

3) Huang M.-Y., Mackey L., Keränen S.V.E., Weber G.H., Jordan M.I., Knowles D.W., Biggin M.D., Hamann B. (2011) **Visually Relating Gene Expression and in vivo DNA Binding Data.** *in: Wu F.-X., Zaki M., Morishita S., Pan Y., Wong S., Christianson A., and Hu, X., eds., Proceedings of 2011 IEEE International Conference on Bioinformatics and Biomedicine, pp. 586-589, Atlanta, Georgia, USA, November 12-15, 2011.*

4) Rübel, O., Ahern S., Bethel E.W., Biggin M.D., Childs H., Cornier-Michel E., DePace A.H., Eisen M.B., Fowlkes C.C., Geddes, C.G.R., Hagen H., Hamann B., Huang M.-Y., Keränen S.V.E., Knowles D.W., Luengo Hendriks C.L., Malik J., Meredith J., Messmer P., Prabhat, Ushizima D., Weber G.H., Wu K. (2010) **Coupling visualization and data analysis for knowledge discovery from multi-dimensional scientific data.** *Procedia Computer Science, Volume 1, Issue 1, Proceedings of International Conference on Computational Science, ICCS 2010*, May 2010, Pages 1751-1758.

5) Rübel, O., Weber G.H., Huang M.-Y., Bethel E.W., Keränen S.V.E., Fowlkes C.C., Luengo Hendriks C.L., DePace A.H., Simirenko L., Eisen M.B., Biggin M.D., Hagen H., Malik J., Knowles D.W., Hamann B. (2008) **PointCloudXplore 2: Visual Exploration of 3D Gene Expression.** *in: Hagen, H., Hering-Bertram, M., and Garth,C., eds, Visualization of Large and Unstructured Data Sets, GI Lecture Notes in Informatics, Vol. S-7, Gesellschaft für Informatik (GI), Bonn, Germany, pp 125-137.*

6) Rübel O., Weber G.H., Keränen S.V.E., Fowlkes C.C., Luengo Hendriks C.L., Simirenko L., Shah N.Y., Eisen M.B., Biggin M.D., Hagen H., Sudar D., Malik J., Knowles D.W., Hamann B. (2006) **PointCloudXplore: Visual analysis of 3D gene expression data using physical views and parallel coordinates.** *in: B. Sousa Santos, T. Ertl and K. Joy (eds.), Data Visualization 2006 (Proceedings of the Eurographics/IEEE-VGTC Symposium on Visualization, Lisbon, Portugal, May), pp. 203-210.*

7) Rübel O., Weber G.H., Keränen S.V.E., Fowlkes C.C., Luengo Hendriks C.L., Simirenko L., Shah N.Y., Eisen M.B., Biggin M.D., Hagen H., Sudar D., Malik J., Knowles D.W., Hamann B. (2006) **PointCloudXplore: A Visualization Tool for 3D Gene Expression Data.** *in: H. Hagen, A. Kerren and P. Dannenmann (eds.), Visualization of Large and Unstructured Data Sets, Lecture Notes in Informatics, Vol. S-4, Gesellschaft für Informatik, Bonn, Germany, pp. 107-117.*

8) Fowlkes C.C., Luengo Hendriks C.L., Keränen S.V.E., Biggin M.D., Knowles D.W., Sudar D., Malik J. (2005) **Registering Drosophila Embryos at Cellular Resolution to Build a Quantitative 3D Map of Gene Expression Patterns and Morphology.** *2005 IEEE Computational Systems Bioinformatics Conference, Workshop on BioImage Data Mining and Informatics, pp. 354-357.*

9) Weber G.H., Luengo Hendriks C.L., Keränen S.V.E., Dillard S.E., Ju D.Y., Sudar D., Hamann B.E. (2005) **Visualization for Validation and Improvement of Three-dimensional Segmentation Algorithms.** *in K. Brodlie, D.J. Duke and K.I. Joy (eds.) Eurographics – IEEE VGTC Symposium in Visualization (2005), pp. 93-100.*

10) Knowles D.W., Keränen, S., Biggin, M.D., Sudar, D. (2002) **Mapping organism expression levels at cellular resolution in developing Drosophila.** *Proceedings of the SPIE - The International Society for Optical Engineering 4621: 57-64.*

Skills

Specialty areas:

- Signaling centers and growth in morphodynamic model of vertebrate dental and craniofacial development and evolution
- Pattern formation in *Drosophila* embryogenesis (3D gene expression and morphology mapping and analyses)

Techniques:

- Fluorescent 3D *in situ* -hybridization and immunohistochemistry for mapping quantitative gene expression at cellular resolution
- 2-photon imaging for 3D data (Zeiss)
- Cellular resolution analyses of 3D image and PointCloud data (PERL, MatLab)
- *In silico* experimentation with and analyses of PointCloud atlases and simpler matrix models
- Large literature data mining and curation for comparison with experimental and theoretical models (*Drosophila* blastoderm system)
- Muroid organ and tissue culture (embryonic dental) for tissue recombination and induction experiments
- Muroid dental histology and anatomy
- Preparation, staining and serial sectioning of muroid craniofacial samples
- Article writing
- Radioactive *in situ* -hybridization