



Faculty Member Profile

Ted P. Rasmussen

Assistant Professor

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Background:

Dr. Rasmussen is originally from the Pacific Northwest and was awarded a B.S. in Biology from the University of Washington in Seattle. He conducted graduate research focused on mechanisms of RNA processing at the University of Wisconsin at Madison where he received a Ph.D. in Genetics. Dr. Rasmussen then worked as a post-doctoral fellow at the Whitehead Institute at MIT where he became interested in the chromatin of stem cells and mouse genetics. Dr. Rasmussen joined the faculty of the Department of Animal Sciences in 2002 and is a founding member of the Center for Regenerative Biology.

Courses Taught:

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ANSC 217 Animal Genetics

ANSC 370 Current Advances in Epigenetics

Research Interests:

Embryonic stem (ES) cells are primitive totipotent cells derived from extremely early embryos. ES cells can be caused to differentiate in vitro to yield many cell types of potential therapeutic value. In principle, any disorder characterized by cell death or organ failure is amenable to treatment with appropriately differentiated stem cells. Protocols have been developed for the guided differentiation of ES cells, but the underlying molecular mechanisms involved in differentiation are poorly understood. New differentiation regimes must be established through trial and error and are plagued by contamination with incorrectly differentiated cells. A better understanding of the molecular mechanisms that govern differentiation processes would further the goal of achieving highly efficient and rationally-

guided differentiation. Chromatin proteins are a diverse set of molecules that associate with DNA and regulate gene expression in a tissue-specific manner. Though largely untested, it is reasonable to suspect that chromatin proteins and chromatin remodeling activities play a substantial role in stem cell differentiation processes. This proposition is supported by research into the mechanisms of X chromosome inactivation (one of the earliest developmental changes in differentiating ES cells) and nuclear transfer (cloning) experiments that suggest that "reprogramming" may have its basis in chromatin remodeling. My lab studies chromatin dynamics in mouse embryonic stem (ES) cells as a model system to understand differentiation processes on a mechanistic level. The mouse ES cell system is powerful, because genetic, molecular, biochemical, and genomics approaches may be brought to bear. Furthermore, mouse ES cells can be readily introduced into live animals to assess their effectiveness. I am currently conducting extensive research on macroH2A1, a specialized histone variant involved in gene silencing and X inactivation. MacroH2A1 seems to be a general component of heterochromatin and is incorporated into the inactive X chromosome of female ES cells during the course of differentiation. My lab is interested in following the association of macroH2A1 protein with specific regions of the genome during the course of stem cell differentiation. In addition, I am interested in the mechanisms that target the formation of specialized chromatin to particular genomic sites. To achieve these goals, we are using aspects of mouse genetics, molecular biology, and biochemistry. My lab is also conducting "discovery science" in an attempt to identify new chromatin components and chromatin regulatory molecules that are important for stem cell differentiation.

Recent Publications:

Rasmussen TP. Developmentally-poised chromatin of embryonic stem cells. *Front Biosci.* 2008 Jan 1;13:1568-77. Review. PMID: 17981649

Spurling CC, Godman CA, Noonan EJ, Rasmussen TP, Rosenberg DW, Giardina C. HDAC3 overexpression and colon cancer cell proliferation and differentiation. *Mol Carcinog.* 2008 Feb;47(2):137-47.

Dai B, Rasmussen TP. Global epiproteomic signatures distinguish embryonic stem cells from differentiated cells. *Stem Cells.* 2007 Oct;25(10):2567-74. Epub 2007 Jul 19.

Ambrosi DJ, Tanasijevic B, Kaur A, Oberfell C, O'Neill RJ, Krueger W, Rasmussen TP. Genome-wide reprogramming in hybrids of somatic cells and embryonic stem cells. *Stem Cells.* 2007 May;25(5):1104-13. Epub 2007 Feb 1. PMID: 17272499

Ambrosi, D.J., Tanasijevic, B., Kaur, A. Oberfell, C., O'Neill, R.J., Krueger, W., and Rasmussen, T.P. (2007) Genome-wide reprogramming in hybrids of somatic cells and embryonic stem cells. *Stem Cells*, 25(5): 1104-1113.

Ambrosi, D.J. and Rasmussen, T.P. (2005) Reprogramming mediated by stem cell fusion. *Journal of Cellular and Molecular Medicine* 9, 320-330.

Ma, Y.H., Jacobs, S.B., Jackson-Grusby, L., Mastrangelo, M.A., Torres-Betancourt, J.A., Jaenisch, R., and Rasmussen, T.P. (2005). DNA CpG hypomethylation induces heterochromatin reorganization involving the histone variant macroH2A. *Journal of Cell Science*, 118, 1607-1616.

Chang, C.C., Ma, Y.H., Jacobs, S., Tian X.C., Yang, X. , and Rasmussen, T.P. (2005). A maternal store of macroH2A is removed from pronuclei prior to onset of somatic macroH2A expression in

preimplantation embryos. *Developmental Biology*, 278, 367-380.

Rasmussen, T.P. (2003). Embryonic stem cell differentiation: a chromatin perspective. *Reproductive Biology and Endocrinology*, 1, 100-107.

Ganesan, S., Silver, D.P., Greenberg, R.A., Avni, D., Drapkin, R., Miron, A., Mok, S.C., Randrianarison, R., Brodie, S., Salstrom, J., Rasmussen, T.P., Klimke, A., Marrese, C., Marahrens, Y., Deng, C.X., Feunteun, J. and Livingston, D.M. (2002). BRCA1 Supports XIST RNA Concentration on the Inactive X Chromosome. *Cell*, 111, 393-405.

Wutz, A., Rasmussen, T.P., and Jaenisch, R. (2002). Chromosomal silencing and chromosomal localisation are mediated by different domains of Xist RNA. *Nature Genetics*, 30:167-74.

Rasmussen, T. P., Wutz, A., Pehrson, J. R., and Jaenisch, R. (2001). Expression of Xist RNA is sufficient to initiate macrochromatin body formation. *Chromosoma* 110, 411-420.

Akbarian, S., Chen, R. Z., Gribnau, J., Rasmussen, T. P., Fong, H., Jaenisch, R., and Jones, E. G. (2001). Expression pattern of the Rett Syndrome Gene MeCP2 in primate prefrontal cortex. *Neurobiology of Disease*. 8, 784-791.

Rasmussen, T. P., Mastrangelo, M. A., Eden, A., Pehrson, J. R., and Jaenisch, R. (2000). Dynamic relocalization of histone MacroH2A1 from centrosomes to inactive X chromosomes during X inactivation. *J Cell Biol* 150, 1189-98.

Rasmussen, T. P., Huang, T., Mastrangelo, M. A., Loring, J., Panning, B., and Jaenisch, R. (1999). Messenger RNAs encoding mouse histone macroH2A1 isoforms are expressed at similar levels in male and female cells and result from alternative splicing. *Nucleic Acids Res* 27, 3685-9.

Rasmussen, T. P., and Culbertson, M. R. (1998). The putative nucleic acid helicase Sen1p is required for formation and stability of termini and for maximal rates of synthesis and levels of accumulation of small nucleolar RNAs in *Saccharomyces cerevisiae*. *Molecular and Cellular Biology* 18, 6885-96.

Rasmussen, T. P., and Culbertson, M. R. (1996). Analysis of yeast trimethylguanosine-capped RNAs by midwestern blotting. *Gene* 182, 89-96.

DeMarini, D. J., Papa, F. R., Swaminathan, S., Ursic, D., Rasmussen, T. P., Culbertson, M. R., and Hochstrasser, M. (1995). The yeast SEN3 gene encodes a regulatory subunit of the 26S proteasome complex required for ubiquitin-dependent protein degradation in vivo. *Molecular and Cellular Biology* 15, 6311-21.

Hobbies and Non-Academic Interests:

Fly fishing and fly tying

Backpacking

Blues Music

Cave Exploring

Favorite Links:

- [Pubmed](#)
- [Mouse Genome Resources](#)
- [Mouse Imprinting](#)
- [The Jackson Laboratory](#)
- [Boston Blues Society](#)