Sergei Nechaev, PhD

Assistant Professor
Department of Basic Sciences
University of North Dakota School of Medicine and Health Sciences
501 N. Columbia Road, Grand Forks, ND 58202
Phone: (701) 777-2566
email: sergei.nechaev@med.und.edu

EDUCATION

- B. Sci. equivalent, Molecular Biology, Moscow State University, 1996.
- M. Sci. equivalent, Biochemistry, Moscow State University, 1997.
- Ph.D., Molecular Biology, Institute of Genetics and Selection of Industrial Microorganisms, Moscow, Russia, 10/2001.

PROFESSIONAL EXPERIENCE

- **Assistant Professor (2012-present).** Department of Basic Sciences, University of North Dakota School of Medicine and Health Sciences, Grand Forks, ND
- Postdoctoral training. Center for Molecular Genetics, University of California, San Diego, California (2002-2006) (Advisor: E. Peter Geiduschek).
- Postdoctoral training, Laboratory of Molecular Carcinogenesis (LMC), NIEHS/NIH, RTP, North Carolina (2006-2011) (Advisor: Karen Adelman).

HONORS, SPECIAL RECOGNITIONS AND AWARDS

- 1996 R. B. Khesin prize for best junior thesis. Institute for Molecular Genetics, Moscow, Russia
- 2010 NIH Fellows Award for Research Excellence (FARE) 2011 award, NIEHS/NIH, Research Triangle Park, North Carolina
- 2014 Highlighted poster presentation at the 5th Biennial NISBRE Symposium, Washington, DC

SELECTED SERVICE ACTIVITIES:

Ad hoc peer-reviewer.

PLOS ONE;
Scientific Reports;
Nucleic Acids Research;
Nucleic Acids Research Methods;
Molecular and Cellular Biology;
Genome Research;
RNA Biology;
Journal of Molecular Biology;
Nature Communications;
Nature Methods.

Instructor.

2014, 2015. Protein Purification and Characterization Course, Cold Spring Harbor Laboratory, Cold Spring Harbor, NY. http://meetings.cshl.edu/courses/2015/c-ppc15.shtml

Reviewer of postdoctoral fellowship applications.
2013, 2014, 2015. Dmitry Zimin Dynasty Foundation Postdoctoral Fellowship panel judge.

Student service.
Serves on 8 PhD and 1 Masters student thesis committees, including one outside SMHS, in the Department of Computer Sciences, UND.

Organized Basic Science Graduate Student Retreat in Bemidji, MN, in September 2014 and in September 2015

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Synergistic activities.
Presentation on Epigenetics at the Osher Lifelong Learning Institute (2013).

Gave a scientific presentation to Biology Undergraduate students in Concordia College (Moorhead, MN) (2013).

Gave a career presentation to Biology Undergraduate students in Concordia College, Moorhead, MN (2013).

Presentation titled "Global Analysis of Pol II Activities: Linking Epigenetics and Gene Transcription" to undergraduate students in the Department of Biotechnology, SIES College of Arts Science and Commerce, Mumbai, India (2012)

INVITED LECTURES AND PRESENTATIONS

- 10/1998 *Transcription Termination Meeting,* Mountain Lake, VA.
- 08/1999 *Molecular Genetics of Bacteria and Phages Meeting*, Madison, WI.
- 08/2004 *Mechanisms of Prokaryotic Transcription*, Cold Spring Harbor Laboratories Meeting. Cold Spring Harbor, NY.
- 06/2005 *FASEB conference on the Mechanism and Regulation of Prokaryotic Transcription*, Saxtons River, VT.
- 06/2005 *General American Society for Microbiology (ASM) meeting*, Atlanta, GA.
- 11/2007 *Atlantic Coast Chromatin Club*, Research Triangle Park, NC.
- 06/2008 *General American Society for Microbiology (ASM) meeting*, Boston, MA.
- 09/2009 *Atlantic Coast Chromatin Club*, Research Triangle Park, NC.
- 09/2010 Department of Biology, University of North Carolina at Greensboro, Greensboro, NC.
- 11/2010 *NIEHS Science Awards Day*, Research Triangle Park, NC.
- 02/2011 Center For RNA Biology Research In Progress Meeting, Duke University, Durham, NC
- 04/2012 Frank Low Research Day, UND School of Medicine, Grand Forks, ND.
- 11/2012 UND Epigenetics and Epigenomics Symposium, Grand Forks, ND
- 09/2013 UND Epigenetics and Epigenomics Symposium, Grand Forks, ND
- 10/2013 ND INBRE annual meeting, Grand Forks, ND
- 04/2014 Cold Spring Harbor Laboratory, Guest Lecturer at Protein Purification and Characterization Course.
- 04/2015 Cold Spring Harbor Laboratory, Guest Lecturer at Protein Purification and Characterization Course.

RESEARCH SUPPORT

Current research support

1. COBRE Epigenetics Research Initiative, P20 GM104360-01
   Title: "RNA polymerase II pausing as a dynamic epigenetic mark in neural stem cell differentiation."
   Role: PD (PI Vaughan)
   Dates: 09/01/2013- 05/31/2018
   Agency: NIH

2. Title: "Epigenomic Profiling of Brain Cancer Cells using small noncoding RNAs".
   Dates: 09/15/2015 – 05/30/2016
   Agency: UND School of Medicine Pilot
   Role: PI
   The goal of this commercialization project is to develop a quantitative PCR plate assay based kit for identification of tumor subtypes based on the analysis of short capped RNAs generated by paused RNA polymerase.

Previous research support

1. Title: "The role of Pol II pausing in cell differentiation"
   Role: PI
   Agency: ND-EPSCoR
   Dates: 1/1/12-08/31/14
   (PI Nechaev)
   The long-term goal of this project is to identify the mechanisms of transcriptional pausing and determine its role in gene expression.

2. Title: Epigenetic regulation of EMT-MET transitions
   Role: Co-PI with Dr. Dhasarathy
   Agency: School of Medicine and Health Sciences
   Dates: 4/1/13-12/31/14
   The long term goal of this project is to determine the role of epigenetic regulation in epithelial to mesenchymal transitions (EMT), using breast cancer cell lines

3. Title: Pol II pausing in neuronal cell differentiation.
   Role: PI
   Agency: School of Medicine and Health Sciences, COBRE Pilot grant
   Dates: 1/1/12-06/01/12
   The goal of this grant is to establish a technique for the analysis of Pol II pausing in mammalian cells.

Pending research support

1. Title: "Identifying Susceptibility of Metastatic Breast Cancers to Chemotherapy Drugs by Targeting Pol II Pausing."
   Agency: METAvivor.
   Dates: 10/2015 – 10/2017

The goal of this project is to determine epigenetic changes pertinent to metastatic breast cancer and relate these changes to the dynamics of Pol II pausing.

PUBLICATIONS:

Pending Peer-Reviewed Publications:

Link to My Bibliography at NCBI:

http://www.ncbi.nlm.nih.gov/sites/myncbi/sergei.nechaev.1/bibliography/47738670/public/?sort=date&direction=descending

Peer-Reviewed Publications:

- Zarns K, Desell T, **Nechaev S** and Dhasarathy A. (2015) Searching the Human Genome for Snail and Slug With DNA@Home. *IEEE e-Science 2015* Conference Proceedings. Accepted

- Chauhan A, Quenumzangbe F, Abbas A, Bradley D, **Nechaev S**, Singh B., Sharma J, Mishra B. (2015) Epigenetic Modulation of Microglial Inflammatory Gene Loci in Helminth-Induced Immune Suppression: Implications for Immune Regulation in Neurocysticercosis. *ASN Neuro*. 7.

- Scheidegger A, Burkholder A, Abbas A, Zarns K, Samarakkody A and **Nechaev S*.** Analysis of paired end Pol II ChIP-seq and short capped RNA-seq in MCF-7 cells. *Genom Data.* **2015 June 25;** 263-267.

- Scruggs, B. S., Gilchrist, D. A., **Nechaev, S.,** Muse, G. W., Burkholder, A., Fargo, D. C. & Adelman, K. Bidirectional Transcription Arises from Two Distinct Hubs of Transcription Factor Binding and Active Chromatin. *Mol Cell* **58**, 1101-1112 (2015).

- Samarakkody, A., Abbas, A., Scheidegger, A., Warns, J., Nnoli, O., Jokinen, B., Zarns, K., Kubat, B., Dhasarathy, A. & **Nechaev, S***. RNA polymerase II pausing can be retained or acquired during activation of genes involved in the epithelial to mesenchymal transition. *Nucleic Acids Res* **43**, 3938-3949 (2015).

- Henriques, T*., Gilchrist, D. A. *, **Nechaev, S.** *, Bern, M., Muse, G. W., Burkholder, A., Fargo, D. C., and Adelman, K. (2013) Stable Pausing by RNA Polymerase II Provides an Opportunity to Target and Integrate Regulatory Signals, *Mol Cell 52*, 517-528.
    - ***Co-first author**

- Twist, K. A., Campbell, E. A., Deighan, P., **Nechaev, S.,** Jain, V., Geiduschek, E. P., Hochschild, A. & Darst, S. A. (2011). Crystal structure of the bacteriophage T4 late-transcription coactivator gp33 with the beta-subunit flap domain of Escherichia coli RNA polymerase. *Proc Natl Acad Sci U S A* **108**, 19961-19966.

- Savalia D, Robins W, **Nechaev S,** Molineux I and Severinov K (2010). The role of the T7 Gp2 inhibitor of host RNA polymerase in phage development, *J Mol Biol* 402 118-126

- **Nechaev S,** Fargo D, dos Santos G, Liu L, Gao Y and Adelman K (2010). Global Analysis of Short RNAs Reveals Widespread Promoter-Proximal Stalling and Arrest of Pol II in Drosophila. *Science* 327, 335-338

- Adelman K, Kennedy M, **Nechaev S,** Gilchrist D, Muse G, Chinenov Y and Rogatsky I (2009). Immediate mediators of the inflammatory response are poised for gene activation through RNA polymerase II stalling. *Proc Natl Acad Sci U S A.* **106:** 18207-18212

- Gilchrist D, **Nechaev S,** Lee C, Collins J, Ghosh S, Gilmour D and Adelman K (2008). NELF-mediated stalling of Pol II can enhance gene expression by blocking promoter-proximal nucleosome assembly. *Genes Dev.* **22:** 1921-1933

- **Nechaev S*** and Geiduschek EP (2008). Dissection of the bacteriophage T4 late promoter complex. *Journal of Molecular Biology.* **379:** 402-413
    - ***corresponding author**

- Zeitlinger J, Stark A, KellisM, Hong J W, **Nechaev S,** Adelman K, Levine M and Young R. (2007) RNA Polymerase Stalling at Developmental Control Genes in the Drosophila Embryo. *Nature Genetics.* **39** :1512-1516

- Muse G, Gilchrist A, **Nechaev S,** Shah R, Parker J, Grissom S, Zeitlinger J and Adelman K (2007) RNA polymerase is poised for activation across the genome. *Nature Genetics.* **39:** 1507-1511

- **Nechaev S*,** Geiduschek EP (2006). The role of an upstream promoter interaction in initiation of bacterial transcription. EMBO J. **25:** 1700-1709
    - ***corresponding author**

- **Nechaev S*,** Kamali-Moghaddam M, Andre E, Leonetti JP, Geiduschek EP.(2004) The bacteriophage T4 late-transcription coactivator gp33 binds the flap domain of *Escherichia coli* RNA polymerase. Proc Natl Acad Sci U S A. **101:**17365-70
    - ***corresponding author.**

- Wigneshweraraj SR, Burrows PC, **Nechaev S,** Zenkin N, Severinov K, Buck M. (2004) Regulated communication between the upstream face of RNA polymerase and the beta' subunit jaw domain. EMBO J. **23:** 4264-74

- Wigneshweraraj S., **Nechaev S.,** Bordes P., Jones S., Cannon W., Severinov K., Buck M. (2003) Enhancer-dependent transcription by bacterial RNA polymerase: the beta subunit downstream lobe is used by sigma 54 during open promoter complex formation. *Methods Enzymol.* **370:** 646- 657

- Yuzenkova J., **Nechaev S.,** Berlin J., Rogulja D., Kuznedelov K., Inman R., Mushegian A., Severinov K. (2003) Genome of Xanthomonas oryzae bacteriophage Xp10: an odd T-odd phage. *J Mol Biol.* **330:** 735-748

- Yuzenkova J., Delgado M., **Nechaev S.,** Savalia D., Epshtein V., Artsimovitch I., Mooney R., Landick R., Farias R., Salomon R., Severinov K. (2002) Mutations of bacterial RNA polymerase leading to resistance to microcin j25. *J Biol Chem.* **277:** 50867-50875

- Wigneshweraraj S., **Nechaev S.,** Severinov K., Buck M. (2002) Beta subunit residues 186-433 and 436-445 are commonly used by Esigma54 and Esigma70 RNA polymerase for open promoter complex formation. *J Mol Biol.* **319:1067-1083**

- **Nechaev S.,** Yuzenkova Y., Niedziela-Majka A., Heyduk T., Severinov K. (2002) A novel bacteriophage-encoded RNA polymerase binding protein inhibits transcription initiation and abolishes transcription termination by host RNA polymerase. *J Mol Biol.* **320,11-22**

- Minakhin, L., **Nechaev, S.,** Campbell, E. A., and Severinov, K. (2001) Recombinant *Thermus aquaticus* RNA polymerase-A new tool for structure-based analysis of transcription. *J. Bacteriol.,* **183,** 71-76

- **Nechaev, S.,** Chlenov, M., and Severinov, K. (2000). Dissection of two hallmarks of the open promoter complex by mutation in RNA polymerase core subunit. *J. Biol. Chem.,* **275,** 25516-25522

- Sharp, M. M., Chan, C. L., Lu, C. Z., Marr, M. T., **Nechaev, S.,** Merritt, E. W., Severinov, K., Roberts, J. W., and Gross, C. A. (1999) The sigma interface with core RNA polymerase is extensive, functionally specialized, and conserved. *Genes & Devel.,* **13,** 3015-3026

- Lohrke, S. M., **Nechaev, S.,** Yang, H., Severinov, K., and Jin, S. (1999) Transcriptional activation of *Agrobacterium tumefaciens* virulence gene promoters in *Escherichia coli* requires the *rpoA* gene from *A. tumefaciens* encoding the α subunit of RNA polymerase. *J. Bacteriol.,* **181,** 4533-4539

- **Nechaev, S.,** and Severinov, K. (1999) Inhibition of *E. coli* RNA polymerase by bacteriophage T7 gene 2 protein. *J. Mol. Biol.,* **289,** 815-826

○ Reviews and Commentaries.

- Scheidegger A and **Nechaev S** (2015). RNA Polymerase II Pausing as a Context-Dependent Reader of the Genome. *Biochemistry and Cell Biology.* In press.

- **Nechaev, S.** and K. Adelman. (2011). Pol II waiting in the starting gates: Regulating the transition from transcription initiation into productive elongation. *Biochim Biophys Acta* **1809:** 34-45

- **Nechaev S** and Severinov K (2008). RapA: Completing the transcription cycle? *Structure.* **16:** 1294-1295

- **Nechaev S** and Adelman K (2008). Promoter-proximal Pol II: when stalling speeds things up. *Cell Cycle.* **7:** 1539-1544

- **Nechaev S** and Severinov K (2008). The Elusive Object of Desire - Interactions of Bacteriophages and Their Hosts. *Current Opinion in Microbiology.* **11:** 186-193.

- **Nechaev S.,** Severinov K (2003) Bacteriophage-induced modifications of host RNA polymerase. *Annu Rev Microbiol.* **57:** 301-322

○ Book Chapters

- **Nechaev S (corresponding author)**, Zenkin A and Severinov K (2009). Regulation of RNA polymerase through its active center. In *RNA Polymerases as Molecular Motors,* in Royal Society for Chemistry, Paris, France. ISBN: 978-0-85404-134-3

- **Nechaev S**., Imburgio D., Severinov K (2003) Purification and characterization of bacteriophage-encoded inhibitors of host RNA polymerase: T-odd phage gp2-like proteins. *Methods Enzymol.* 370: 212-225