

# NICHOLAS BORCHERDING, MD PHD

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## Education

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<b>Medical Doctorate</b> University of Iowa, Iowa City, IA	June 2014 – May 2020
<b>Cancer Biology, Ph.D.</b> University of Iowa, Iowa City, IA	June 2016 – May 2020
<b>Pathology, M.S.</b> University of Iowa, Iowa City, IA	August 2012 – June 2014
<b>Nutritional Science, B.S.</b> Iowa State University, Ames, IA	January 2009 – May 2012

## Appointments

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<b>Clinical Pathology Resident</b> Physician Scientist Training Program (PSTP) Department of Pathology and Immunology Washington University, St Louis, MO	July 2020 – Present
<b>Research Adjunct Appointment</b> Department of Dermatology University of Iowa, Iowa City, IA	May 2020 – Present
<b>Graduate Research Assistant</b> Program: Cancer Biology Graduate Program, Ph.D. Mentor: Dr. Weizhou Zhang Department of Pathology University of Iowa, Iowa City, IA	June 2016 – December 2018
<b>Graduate Research Assistant</b> Program: Pathology Graduate Program, M.S. Mentor: Dr. Weizhou Zhang Department of Pathology University of Iowa, Iowa City, IA	August 2012 – June 2014
<b>Undergraduate Research Assistant</b> Mentor: Dr. Matthew Rowling and Dr. Kevin Schalinske Department of Food Science and Human Nutrition Iowa State University, Ames, IA	May 2010 – August 2012
<b>Louise Rosenfeld Undergraduate Research Intern</b> Mentor: Dr. Matthew Rowling Department of Food Science and Human Nutrition Iowa State University, Ames, IA	August 2011 – December 2011

## Publications

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1. **Borcherding, N.** & Gronowski, A. Commentary on a case of Unexpected Hyperglycemia. (2021). *Clinical Chemistry*. In press.
1. Merritt, N., Garcia, K. Rajendran, D., Lin, Z.Y., Zhang, X., Mitchell, K., **Borcherding, N.**, Fullenkamp, C., Chimenti, M., Gingras, A.C., Harvey, K., & Tanas, M. (2021) TAZ-CAMTA1 and YAP3-TFE3 modulates the basal TAZ/YAP transcriptional program by recruiting the ATAC histone acetyltransferase complex. *eLife*. In Press.
2. Mathew, N.R., Jayanthan, J.K, Smirnov, I, Robinson, J.L. Axelsson, H., Nakka, S.S., Emmanouilidi, A., Czarnewski, P., Yewdell, W.T., Lebrerio-Fernandez, C, Bernasconi, V., Rodin, W., Harandi, A.M, Lycke, N., **Borcherding, N.**, Yewdell, J.W., Greiff, V., Bemarker, M., & Angeletti, D., (2021) Single-cell BCR and RNA analysis after respiratory virus infection reveals spatiotemporal dynamics of antigen-specific B cell response. *Cell Reports*. In press.
3. Kolb, R., De, U., Khan, S., Luo, Y., Kim, M., Yu, H., Wu, C., Zhang, X., Zhang, X., **Borcherding, N.**, Zheng, G., Zhou, D., & Zhang, W. (2021). Targeting tumor-infiltrating regulatory T cells by PROTAC-mediated degradation of BCL-XL. *Nature Communications*. In Press.
4. **Borcherding, N.\***, Vishwakarma, A.\*, Voigt, A.P., Nepple, K., Salem, A., Jenkins, R.W., Zhang, W., Zakharia, Y. (2021) Mapping the Immune Landscape in Clear Cell Renal Carcinoma by single-cell genomics. *Communications Biology*. PMID: 33504936. \*co-primary authors
5. Cheng, Y., **Borcherding, N.**, Ogunsakin, A., Lemke-Miller, C.D., Gibson-Corley, K.N., Rajan, A., Wongpattaraworakul, W., Chan, C.H., Salem, A.K., Weiner, G.J., Simons, A.L. (2021). The anti-tumor effects of cetuximab in combination with motolimod are T cell dependent. *Scientific Reports*. PMID: 33452311.
6. Gu, V.W., Cho, E., Thompson, D.T., Cassady, V., **Borcherding, N.**, Koch, K.E., Wu, V.T., Lorenzen, A.W., Kulak, M.V., Williams, T., Zhang, W., Weigel, R.J. (2021). AP-2 $\gamma$  is Required for Maintenance of Pluripotent Mammary Stem Cells. *Stem Cell Reports*. PMID 33382976.
7. Swami, U., Chennamadhavuni, A., **Borcherding, N.**, Bossler, A.D., Mott, S.L., Garje, R., Zakharia, Y., & Milhem, M.M. (2020). Multivariate analysis of 169 cases of advanced cutaneous melanoma to evaluate antibiotic exposure as a predictor of survival to anti-PD-1 based immunotherapies. *Antibiotics*. PMID: 33120998.
8. **Borcherding, N.**, Jethava, Y., Vikas, P. (2020). Repurposing anti-cancer drugs for COVID-19. *Drug Design, Development and Therapy*. PMID 33239864.
9. Renavikar, P.S., Sinha, S., Brate, A.A., **Borcherding, N.**, Crawford, M.P., Steward-Tharp, S., & Karandikar, N. (2020). IL-12-mediated induction of immune suppressive deficit during CD8+ differentiation. *Frontiers in Immunology*. PMID: 33193343.
10. Crawford, M.P., Sinha, S., Renavikar, P.S., **Borcherding, N.**, & Karandikar, N. (2020). Novel role for the T-helper 17 signature cytokine IL-17: CD4 resistance to immune suppression. *PNAS*. PMID: 32719138.
11. **Borcherding, N.**, Crotts, S.B., Ortolan, L.S., Bormann, N.L., Jabbari, A. (2020). A transcriptomic atlas of murine and human alopecia areata identifies immune cell profiles predictive of human disease state. *Journal of Clinical Investigations Insights*. PMID: 32453712.
12. Vikas, P.\*, **Borcherding, N.\***, Chennamadhavuni, A., Garje, R. (2020). Therapeutic potential of combining PARP inhibitor and immunotherapy in solid tumors. *Frontiers in Oncology*. PMID: 32457830. \*co-primary authors
13. Kluz, P.N., Kolb, R., Xie, Q., **Borcherding, N.**, Liu, Q., Wang, L., Zhang, Y., Li, W., Stipp, C., Gibson-Corley, K.N., Zhao, C., Qi, H.H., Bellizzi, A., Tao, A.W., Sugg, S., Weigel, R.J., Shen, X., Zhang, W. (2020). Cancer cell-intrinsic function of CD177 in attenuating  $\beta$ -Catenin signaling. *Oncogene*. PMID: 32042113.
14. **Borcherding, N.\***, Bormann, N., & Kraus, G. (2020). scRepertoire: A R-based toolkit for single-cell immune receptor analysis. *F1000Research*. PMID: 32789006. \*first and corresponding author
15. Liu, Q., **Borcherding, N.**, Shao, P., Maina, P., Zhang, W., & Qi, H. (2019) Contribution of synergism between PHF8 and HER2 signaling to breast cancer development and drug resistance. *EBioMedicine*. PMID: 31923801.
16. Xiu, Y., Qianze Dong, Q., Fu, L., Bossler, A., Tang, X., Boyce, B., **Borcherding, N.**, Byrd, J., Leidinger, M., Sardina, J.L., Xue, H., Li, Q., Feldman, A., Aifantis, I., Boccalatte, F., Khoury, J., Wang, W., Hu, S., Yuan, Y., Wang, E., Yuan, J., Colgan, J., Habelhah, H., Waldschmidt, T., Muschen, M., & Zhao, C.

- (2020). Concurrent activation of NF- $\kappa$ B and Notch signaling is sufficient to induce B cell transformation and enables B-myeloid conversion. *Blood*. PMID: 31697816
17. Wu, V., Kiriazov, B., Koch, K., Gu, V., Beck A., **Borcherding, N.**, Li, T., Addo, P., Wehrspan, Z., Zhang, W., Braun, T., Brown, B., Band, V., Band, B., Kulak, M., & Weigel, R. (2020). A TFAP2C Gene Signature is Predictive of Outcome in HER2-positive Breast Cancer. *Molecular Cancer Research*. PMID: 31619506
  18. Bi, J., Yang, S., Li, L., Dai, Q., **Borcherding, N.**, Wagner, B.A., Buettner, G.R., Spitz, D.R., Leslie, K.K., Zhang, J., & Meng, X. (2019). Metadherin (MTDH) Enhances Vulnerability of Cancer Cells to Ferroptosis. *Cell Death and Disease*. PMID: 31527591.
  19. Liu, Q.\* , **Borcherding, N.\***, Shao, P., Cao, H., Zhang, W., & Qi, H. (2019). Identification of novel TGF- $\beta$  regulated genes with pro-migratory roles. *Molecular Basis of Disease*. PMID: 31449970 \*co-primary authors
  20. Pandey, G.\* , **Borcherding, N.\***, Kolb, R., Kluz, P., Li, W., Sugg, S., Zhang, J., Lai, D., & Zhang W. (2019). ROR1 potentiates FGFR signaling in basal-like breast cancer. *Cancers*. PMID: 31137681. \*co-primary authors
  21. **Borcherding, N.**, Voigt, A., Liu, V., Link, B.K., Zhang, W., & Jabbari, A. (2019) Single-cell profiling of cutaneous T-cell lymphoma reveals underlying heterogeneity associated with disease progression. *Clinical Cancer Research*. PMID: 30718356
  22. Kolb, R., Kluz, P., Wei, T.Z., **Borcherding, N.**, Bormann, N., Balczak, L., Zhu, P., Davies, B., Gourronc, F., Gibson-Corley, K. Klingelhutz, A., Tan, N.S., Sutterwala, F., Vishwakarma, A., Liu, L., Ge, X., Jiang, B., Zhu, Y., Shen, X., & Zhang, W. (2019). Obesity-associated inflammation promotes angiogenesis and breast cancer via angiopoietin-like 4. *Oncogene*. PMID: 30518876
  23. Vikas, P., **Borcherding, N.**, & Zhang, W. (2019). The Clinical Promise of Immunotherapy in Triple-Negative Breast Cancer. *Clinical Management and Research*. PMID:30573992
  24. **Borcherding, N.**, Bormann, N., Voigt, A., & Zhang, W. (2018). TRGAted: A web tool for survival analysis using protein data in the Cancer Genome Atlas. *F1000Research*. PMID: 30345029
  25. **Borcherding, N.\***, Cole, K.\* , Kluz, P., Pandey, G., Jorgensen, M., Kolb, R., Bellizzi, A., & Zhang, W. (2018). Reevaluating E-Cadherin and  $\beta$ -Catenin: A pan-cancer proteomic approach with emphasis on breast cancer. *American Journal of Pathology*. PMID: 29879416 \*co-primary authors
  26. **Borcherding, N.**, Kolb, R., Gullicksrud, J., Vikas, P. Zhu, Y., & Zhang, W. (2018). Keeping tumors in check: A mechanistic review of clinical response and resistance to immune checkpoint blockade in cancer. *Journal of Molecular Biology*. PMID: 29800567.
  27. Sinha, S., **Borcherding, N.**, Renavikar, P., Crawford, M., & Karandikar. (2018). Autoimmune disease risk SNP rs2281808 in *Sirpy* is associated with heightened effector state and greater cytotoxic potential in human CD8 T-cells. *Scientific Reports*. PMID: 30337675.
  28. Xiu, Y., Li, Q., Li, F., Boyce, B., **Borcherding, N.**, Xue, X., & Zhao, C. (2017). Stabilization of NF- $\kappa$ B-inducing kinase suppresses MLL-AF9-induced acute myeloid leukemia. *Cell Reports*. PMID: 29320732.
  29. Liu, Q., Kulak, M., **Borcherding, N.**, Maina, P., Zhang, W., Weigel, R., & Qi, H. (2017). A novel *HER2* gene-body enhancer contributes to *HER2* expression. *Oncogene*. PMID: 29035388.
  30. Fleagle, T., **Borcherding, N.**, & Hoffmann, D. (2017) A series of Custom 3D Anatomy Videos to Improve Preparation for Gross Anatomy Lab Dissection. *Anatomical Science Education*. PMID: 29283505
  31. Kolb, R., Phan L., **Borcherding, N.**, Liu, Y., Yuan, F., Janowski, A.M., Xie, Q., Markan, K.R., Li, W., Potthoff, M.J., Fuentes-Mattei, E., Knudsen, M., Lee, M., Yeung, S., Cassel, S., Sutterwala, F., & Zhang, W. (2016). Obesity-associated NLRC4 inflammasome activation drives breast cancer progression. *Nature Communications*. PMID: 27708283.
  32. **Borcherding, N.\***, Rudolph, M.\* , Tierney, A.\* , Vyn, & R., Hoffmann. (2016) Content evaluation, usage profile and student preferences related to a medical student wiki for student-authored learning resources. *Medical Science Educator*: 1-10. \*co-primary authors
  33. Kusner, D.\* , **Borcherding, N.\***, & Zhang, W. (2016) Paracrine WNT5A signaling in the mammary healthy and neoplastic mammary tissue. *Molecular & Cellular Oncology*. PMID: 27308558. \*co-primary author
  34. **Borcherding, N.**, Bormann, N., Kusner, D., Kolb R., & Zhang, W. (2015) Transcriptome analysis of basal and luminal tumor-initiating cells in ErbB2-driven breast cancer. *Genomic Data*. PMID: 26167451.

35. Schaefer, K., Toral, M., Velez, G., Cox, A., Baker, S., **Borcherding, N.**, Colgan, D., Bondada, V., Mashburn, C., Yu, C., Geddes, J., Tsang, S., Bassuk, A., & Mahajan, V. (2016). Calpain-5 expression in the retina localizes to photoreceptor synapses. *Investigative Ophthalmology and Visual Science*. PMID: 27152965.
36. **Borcherding, N.\***, Kusner, D.\*, Kolb, R., Xie, Q., Li, W., Yuan, F., Velez, G., Askeland, R., Weigel, R.J., & Zhang, W. (2015). Paracrine WNT5A Signaling Inhibits Expansion of Tumor-Initiating Cells. *Cancer Research*. PMID: 25769722. \*co-primary authors
37. Mahauad-Fernandez, W.D.\*, **Borcherding, N. C.\***, Zhang, W., & Okeoma, C.M. (2015). Bone Marrow Stromal Antigen 2 (BST-2) DNA Is Demethylated in Breast Tumors and Breast Cancer Cells. *PLoS One*. PMID: 25393878. \*co-primary authors
38. Reed, S.M., Hagen, J., Muniz, V.P., Rosean, T.R., **Borcherding, N.**, Sciegienka, S., Goeken, J.A., Naumann, P.W., Zhang, W., Tompkins, V.S., Janz, S., Meyerholz, D.K., & Quelle, D.E. (2014). NIAM-deficient mice are predisposed to the development of proliferative lesions including B-cell lymphomas. *PLoS One*. PMID: 25393878
39. Xie, Q., Klesney-Tait, J., Keck, K., Parlet, C., **Borcherding, N.**, Kolb, R., Li, W., Tygrett, L., Waldschmidt, T., Olivier, A., Chen, S., Liu, G. H., Li, X., & Zhang, W. (2015). Characterization of a novel mouse model with genetic deletion of CD177. *Protein & Cell*. PMID: 25359465
40. **Borcherding, N.**, Kusner, D., Liu, G. H., & Zhang, W. (2014). ROR1, an embryonic protein with an emerging role in cancer biology. *Protein Cell*. PMID: 24752542.
41. Wu, X., Zhang, W., Font-Burgada, J., Palmer, T., Hamil, A. S., Biswas, S. K., Poidinger, M., **Borcherding, N.**, Xie, Q., Ellies, L. G., Ltyle, N. K., Wu, L. W., Fox, R. G., Yang, J., Dowdy, S. F., Reya, T., & Karin, M. (2014). Ubiquitin-conjugating enzyme Ubc13 controls breast cancer metastasis through a TAK1-p38 MAP kinase cascade. *Proceedings of the National Academy of Science*. PMID: 25189770.
42. Smazal, A. L.\*, **Borcherding, N. C.\***, Anderegg, A. S., Schalinske, K. L., Whitley, E. M., & Rowling, M. J. (2013). Dietary resistant starch prevents urinary excretion of 25-hydroxycholecalciferol and vitamin D-binding protein in type 1 diabetic rats. *Journal of Nutrition*. PMID: 23677864. \*co-primary authors
43. Zhang, W., Tan, W., Wu, X., Poustovoitov, M., Strasner, A., Li, W., **Borcherding, N.**, Ghassemian, M., & Karin, M. (2013). A NIK-IKKalpha module expands ErbB2-induced tumor-initiating cells by stimulating nuclear export of p27/Kip1. *Cancer Cell*. PMID: 23602409.

## Submitted Manuscripts

1. Subramani, S., Bellizzi, A., **Borcherding, N.**, Kao, S., Dillon, J., Howe, J., Norris, A.N., Tansey, M., & Pinnaro, C. (2021) Hypoglycemia secondary to insulinoma masking the onset of type 1 diabetes in an adolescent.
2. Lasrado, N., **Borcherding, N.**, Arumugam, R., Starr, T.K., & Reddy, J. (2021). Dissecting the transcriptome Network and Cellular Heterogeneity in Viral Myocarditis by Single-Cell RNA Sequencing.
3. Amanat, F., Thapa, M., Lei, T., Sayed, Ahmed, S.M., Adelsberg, D., Cerreno, J.M., Strohmeier, S., Schmitz, A.J., Zafar, S., Zhou, J.Q., Rejnink, W., Alshammery, H. **Borcherding, N.**, Reiche, A.G., Strivastava, K., Sordillo, E., van Bakel, H., The Personalized Virology Initiative, Bajic, G., Simon, V., Ellebedy, A.H., & Krammer, F. (2021). The plasmablast response to SARS-CoV-2 mRNA vaccination is dominated by non-neutralizing antibodies that target both the NTD and the RBD.
4. He, M., Roussak, K., Ma, F., Garin, V., Schutt, C., Jensen, T.I., **Borcherding, N.**, Zhao, Y., Bhatia, H., Korenfeld, D., Dinkel, S., Gray, J., Ulezko, A., Donoermeyer, D., Arlehamn, C., Gubin, M.M., Pellegrini, M., Sett, A., Tung, T., Bak, R. Modlin, R., Fieds, R.C., Shreiber, R.D., Allen, P.M., Klechevsky, E. (2021). CD5 Expression by dendritic cells directs T cell immunity and sustains immunotherapy response
5. Reynolds, D., Vazquez Guillamet, C., Day, A., **Borcherding, N.**, Vazquez Guillamet, R., Chorenoparra, J.A., House, S.L., O'Halloran, J.A., Zuniga, J., Ellebedy, A.H., Byers, D.E., Mudd, P.A. (2021) Circulating plasma CXCL10/IP-10 serves as a biomarker of excessive bronchoalveolar inflammation and respiratory failure in patients with influenza and COVID-19.
6. Fujiwara, Y., Torphy, R.J., Miller, E.N., **Borcherding, N.**, Zhang, W., Schulick, R.D., & Zhu, Y. (2020). The BigLen/GPR171 pathway suppresses T cell activation and limits antitumor immunity.
7. **Borcherding, N.**, Crawford, M., & Karandikar, N. (2020) IL-17 cytokines preferentially act on naïve CD4+ T cells.

8. **Borcherding, N.\***, Ahmed, K.A.\*, Voigt, A.P., Vishwakarma, V., Kolb, R., Kluz, P., Pandey, P., De, U., Kim, M., Drashansky, T., Helm, E.Y., Zhang, X., Gibson-Corley, K.N., Klesney-Tait, J., Zhu, Y., Lu, J., Lu, J., Huang, X., Cheng, J., Avram, D., Zhou, D., Bacher, R., Zheng, S., Wu, X., Zakharia, Y., Weizhou Zhang, W. (2020). Understanding the heterogeneity and potentially targeting of human tumor-infiltrating regulatory T cells. \*co-primary authors

## Textbooks or Chapters

- Kolb, R., **Borcherding, N.**, & Zhang, W. (2020). Understanding and targeting human cancer regulatory T cells to improve cancer therapy. *T Regulatory Cells in Health and Disease*. London, UK: *Springer Nature*. ISBN 978-981-15-6407-9
- Zhang, W., **Borcherding, N.**, Kolb, R. (2019) IL-1 signaling in the tumor microenvironment. *Tumor Microenvironment*. New York City, NY: Springer International Publishing. ISBN: 978-3-030-34025-4.
- Schalinke, K. & **Borcherding, N.** (2016). *Advanced Nutrition and the Regulation of Metabolism*. San Diego, CA: *Cognella Academic Publishing*. ISBN: 978-1-5165-1468-7

## Software

- **Borcherding, N.** (2021) Clone Ranger: Clinical tools for clonal analysis
- **Borcherding, N.** (2020). Exigence: Fix Excel gene autoconversion.
- **Borcherding, N.** and Andrews, J. (2020). Escape: Easy single cell platform for enrichment. DOI: 10.18129/B9.bioc.escape.
- **Borcherding, N.** (2020). Scone: Single-cell operation for neat enrichment. DOI: 10.5281/zenodo.3714898.
- **Borcherding, N.** (2020). scRepertoire, an R-based toolkit for single-cell immune profiling. DOI:10.5281/zenodo.3612216.
- **Borcherding, N.** (2017). TRGAted, using TCGA protein-level data for large-scale survival analysis. R Shiny App. DOI:10.5281/zenodo.1323828.

## Presentations

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### Invited Presentations

- **Borcherding, N.**, Crotts, S., Ortolan, L., Bormann, N., & Jabbari, A. (2020, May). Single-cell mRNA sequencing of murine and human alopecia areata identifies immune cell profiles predictive of human disease state. Presented at the Academy of Clinical Laboratory Physicians and Scientists Annual Meeting in Iowa City, IA.
- **Borcherding, N.**, Voigt, A., Liu, V., Link, B.K., Zhang, W., & Jabbari, A. (2019, May) Single-cell profiling of cutaneous T-cell lymphoma reveals underlying heterogeneity associated with disease progression. Presented at the Society for Investigative Dermatology Annual Meeting in Chicago, Illinois.
- **Borcherding, N.**, Transcriptional Heterogeneity in cancer-associated regulatory T cells is predictive of survival. Presented at the Single-Cell RNA sequencing Symposium by the Iowa Institute of Genetics, Iowa City, Iowa.
- **Borcherding, N.** Paracrine Regulation of Breast Cancer Tumorigenesis. (2016, April). Presented at the Midwestern Association of Graduate Schools Annual Conference in Chicago, Illinois.

### Research Presentations

- **Borcherding, N.**, Cascading through Coagulation (2021, March). Presented at the Department of Pathology and Immunology Case Conference at Washington University School of Medicine.
- **Borcherding, N.**, Acute Encephalopathy and Cerebellitis (2020, December). Presented at the Department of Pathology and Immunology Case Conference at Washington University School of Medicine.
- **Borcherding, N.**, Jo, S., Zhang, W. Targeting mismatch repair in immunotherapy for basal-like breast cancer (2017, January). Presented at the Holden Comprehensive Center Translational Conference at

the University of Iowa.

- **Borcherding, N.** The Potential Dichotomous Functions of  $\beta$ -Catenin in Breast Cancer Molecular Subtypes (2016, November). Presented at the MCB seminar at the University of Iowa.
- **Borcherding, N.** Paracrine Regulation of Breast Cancer Tumorigenesis. (2016, March). Presented at the Jakobsen Graduate Conference for the University of Iowa.
- **Borcherding, N.** The potential of noncanonical WNT as a target for triple-negative breast cancer. (2015, July). Presented at the University of Iowa MSTP Annual Retreat.
- **Borcherding, N.** Aptamer-siRNA chimera generation for T regulatory cell inhibition. (2014, August). Presented at the University of Iowa MSTP Annual Retreat.
- **Borcherding, N.** Noncanonical Wnt Signaling in Breast Cancer Initiation and Progression. (2014, May). Presented in fulfillment of Department of Pathology Graduate Program thesis requirements.
- **Borcherding, N.,** Kusner, D., Kolb R., Li W., Zhang W. (2014, April). ROR1/WNT5a axis role in breast cancer initiation and progression. Presented at the Department of Pathology Graduate Research Seminar.
- **Borcherding, N.,** Xie Q., Kolb R., Li W., Zhang W. (2013, November). Wnt5a, a basal-specific tumor suppressor in ErbB2+ Breast Cancer. Presented at the Department of Pathology Graduate Research Seminar.
- **Borcherding, N.,** Xie Q., Kolb R., Li W., Zhang W. (2013, April). Characterization of Tumor-initiating Cell population in HER2+ Breast Cancer. Presented at the Department of Pathology Graduate Research Seminar.
- **Borcherding, N.,** Xie Q., Li W., Zhang W. (2012, November). Genetic Signature of ErbB2+ Cell of Origin(s). Presented at the Department of Pathology Graduate Research Seminar.

## Abstracts

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### National or Regional Conference Abstracts

- Lasrado, N, **Borcherding, N.,** Arugmugam, R., Starr, T.K., & Reddy, J. Dissecting the complexity of heart infiltrates in post-infectious myocarditis induced with CVB3 infection by single-cell RNA sequencing analysis. (2021, May). Presented at the American Association of Immunologist Annual Meeting.
- **Borcherding, N.,** Henderson, N., Ortolan, L., Liu, V., Link, B.K., Mangold, A., Jabbari, A. Comprehensive transcriptional and clonotypic analysis of peripheral blood in Sezary syndrome reveals novel expression markers and shifting gene profiles associated with treatment. (2021, March). Presented at the United States and Canada Association of Pathology Annual Meeting.
- **Borcherding, N.** Combining single-cell and AIRR data (2020, December). Presented at the Adaptive Immune Receptor Repertoire Society Annual Meeting.
- Rauckhorst, A.J., **Borcherding, N.,** Kraus, A.S., Scerbo, D., & Taylor, E.B. (2020, September). Preserving the in vivo metabolome and energy-sensitive phosphoproteome requires rapid freezing of tissue samples. Presented at the Metabolomics Association of Northern America Annual Meeting.
- **Borcherding, N.,** Crotts, S., Ortolan, L., Bormann, N., & Jabbari, A. (2020, May). Single-cell mRNA sequencing of murine and human alopecia areata identifies immune cell profiles predictive of human disease state. Presented at the Academy of Clinical Laboratory Physicians and Scientists Annual Meeting in Iowa City, IA.
- Renavikar, P., Sinha, S., Brate, A., Crawford, M., **Borcherding, N.,** Steward, S. & Karandikar, N. (2020, May). Immune suppressive deficit in human Tc1 cells secondary to IL-12-induced pathways. Presented at the Academy of Clinical Laboratory Physicians and Scientists Annual Meeting in Iowa City, IA.
- Hoffmann, D., Feagle, T., & **Borcherding, N.** (2020, April). Virtual Anatomy Videos for Pre-Lab Preparation: Does Usage Correlate with Grade Outcomes. Accepted to Experimental Biology Annual Meeting in San Diego, CA. (Canceled due to COVID-19).
- Cole, K., Councilman, K., Zhang, W., & **Borcherding N.** (2020, March). WNT/ $\beta$ -Catenin Signaling Correlates with Improved Survival in Luminal A Breast Cancer. Presented at the USCAP Annual Meeting in Los Angeles, CA.

- Vishwakarma, A., **Borcherding, N.**, Chementi, M., Vishwakarma, P., Nepple, K., Salem, A., Jenkins, R.W., Zhang, W., Zakharia, Y (2019, November). Mapping immune landscape in clear cell renal carcinoma by single-cell genomics. Presented at the AACR Special Conference on Tumor Immunology and Immunotherapy in Boston, MA.
- **Borcherding, N.**, Voigt, A., Liu, V., Link, B.K., Zhang, W., & Jabbari, A. (2019, May) Single-cell profiling of cutaneous T-cell lymphoma reveals underlying heterogeneity associated with disease progression. Presented at the Society for Investigative Dermatology Annual Meeting in Chicago, IL.
- **Borcherding, N.**, Bormann, N., Zhang, W. (2018, January). Using data analytics to predict and improve cancer immunotherapy response. Presented at the American Physician Scientist Association Midwest Regional Meeting in Iowa City, IA.
- **Borcherding, N.**, Jo, S., Zhang, W. (2017, October). Targeting mismatch repair for basal-like breast cancer. Presented at the Cancer Biology Training Consortium Annual Meeting in Portland, OR.
- Feagle, T., **Borcherding, N.**, Hoffmann, D. Students Prefer 3D Anatomy Videos for Prelab Preparation Compared to Traditional Resources and Usage is Related to Class Performance. Presented at the annual Experimental Biology Conference in Chicago, IL.
- Kolb, R., Kluz, P., Wei, T.Z., Bormann, N., **Borcherding, N.**, Markan, K., Pothoff, B., Tan, N.S., Sutterwala, F., & Zhang W. (2017, February). IL-1beta promotes obesity-driven breast cancer progression through the upregulation of Angptl4 in adipocytes. Presented at Inflammation-driven Cancer: Mechanisms to Therapy Keystone Symposia in Keystone, CO.
- Schaefer, K.A., Toral, M., Velez, G., Cox, A., Baker, S., **Borcherding, N.**, Colgan, D.F., Smits, M.M., Bondada, V., Mashburn, C.B., Yu, C., Geddes, J., Tsang, S.H., Bassuk, A.G., Mahajan, V.B. (2016, June). Calpain-5 expression in the retina localizes to photoreceptor synapses. Presented at the FASEB Conference for The Biology of Calpains in Health and Disease in Big Sky, MT.
- Kolb, R., Phan, L., **Borcherding, N.**, Liu, Y., Yuan, F., Janowski, A.M., Xie, Q., Markanm K., Li, W., Pothoff, M., Fuentes-Mattei, E., Ellies, L., Knudson, M., Lee, M., Yeung, S., Cassel, S., Sutterwala, F., & Zhang, W. (2016, January). Obesity-induced Nlr4 inflammasome promote angiogenesis in breast cancer. Presented at the AACR Special Conference: The Function of Tumor Microenvironment in Cancer in San Diego, CA.
- Kolb, R., **Borcherding, N.**, Liu, Y., Yuan, F., Xie, Q., Sutterwala, F., Zhang, W. (2015, April). NLRC4 inflammasome promotes breast cancer progression in diet-induced obese mice. Presented at the American Association for Cancer Research Annual Meeting in Philadelphia, PA.
- **Borcherding, N.**, Kusner, D., Kolb, R., Xie, Q., Zhang, W. (2015, April). Paracrine Wnt5a signaling inhibits the expansion of tumor initiating cells via Ryk/TGFβR/Smad2. Presented at the ASCI/AAP/APSA Annual Joint Meeting in Chicago, IL.
- **Borcherding, N.**, Kusner, D., Kolb, R., Xie, Q., Zhang, W. (2014, April). Wnt5a/ROR1 Axis in Triple Negative Breast Cancer Progression and Potential Therapy. Presented at the American Association for Cancer Research Annual Meeting in San Diego, CA.
- Kolb, R., Liu, Y., Xie, Q., **Borcherding, N.**, Li, W., Zhang, W. (2014, April). Inflammasome activation in obesity-associated breast cancer progression. Presented at the American Association for Cancer Research Annual Meeting in San Diego, CA.
- Xie, Q., **Borcherding, N.**, Kolb, R., Zhang, W. (2014, April). CD177, A novel Metastasis Suppressor of Breast Cancer. Presented at the American Association for Cancer Research Meeting, San Diego, CA.

## Teaching Experience

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### Medical School:

**Liaison Committee** – University of Iowa

- 2014 MED 8123, “Foundations of Cellular Life.” Drs. Darren Hoffmann and Nathan Swaile.

### Medical Tutor

- 2015 MED 8124, “Mechanisms of Health and Disease I” Drs. Andy Russo and Brad Gelbach

### Small Group Facilitator

- 2017 MED 8222, “Medicine and Society III”

- 2016 MED 8222, “Medicine and Society III”

### Other Activities

- 2020 Panelist for Trainee-to-Trainee Pathology PSTP Panel  
AAMC Subcommittee Physician Scientist Postgraduate Training
- 2018 Presenter, Targeting Cancer Mini Medical School  
Carver College of Medicine, University of Iowa
- 2017 Performance and Accreditation Tracker Developer  
Carver College of Medicine, University of Iowa
- 2015-17 Medical School Curriculum Development Assistant,  
Carver College of Medicine, University of Iowa
- 2015 Teaching Your Research Workshop,  
Graduate College, University of Iowa
- 2015-16 Undergraduate Research Festival Poster Judge,  
Iowa Center for Research by Undergraduates, University of Iowa

### Undergraduate University:

#### Undergraduate Teaching Assistant - Iowa State University

- 2012 FSHN 492, “Research Concepts in Human Nutrition.” Dr. Matthew Rowling
- 2011 FSHN 360, “Advanced Human Nutrition and Metabolism.” Dr. Kevin Schalinske
- 2011 FSHN 265, “Nutrition for a Healthy and Active Lifestyle.” Dr. Matthew Rowling

## Committees

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### National

- 2016-17 First Aid/USMLE-Rx Student Council

### University

- 2019-20 Alpha Omega Alpha Selection Committee  
Carver College of Medicine, University of Iowa
- 2018-19 Presidential Charter Committee Review  
University of Iowa Graduate and Professional Student Government
- 2016-17 LCME Accreditation Review Taskforce, Carver College of Medicine, University of Iowa  
Member, Standard 6: Competencies, Curricular Objectives, and Curricular Design
- 2016-17 Medical Education Council, Carver College of Medicine, University of Iowa  
Served on the Committee for Biomedical Informatics Integration
- 2016-17 Student Education Council, Carver College of Medicine, University of Iowa
- 2015-18 Presidential Charter Committee for Recreational Services, University of Iowa  
Graduate Student Member  
Chair of Committee 2017-2018
- 2014-18 University of Iowa Research Council  
Graduate Student Member  
Served on the Research Reward Subcommittee (2014)  
Served on the Undergraduate Research Subcommittee (2014-15)  
Served on the Research Efficiency Subcommittee (2016)
- 2013-16 Graduate and Professional Student Government, University of Iowa  
Serving on the Grants Committee
- 2013-14 Graduate Student Senate, University of Iowa  
Department of Pathology Senator  
Served on the Jakobsen Graduate Conference Committee
- 2011-12 College of Human Sciences Council, Iowa State University  
Served on the Grant and Service Committee

## Departmental

- 2014-15 Retreat and Research Conference Committee  
Medical Scientist Training Program, University of Iowa
- 2011-12 Undergraduate Seat on the Technology Committee, Iowa State University  
Department of Food Science and Human Nutrition

## Professional Memberships

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### National

- 2020- Member  
United States and Canadian Academy of Pathology
- 2014- Full Member  
American Physician Scientist Association
- 2014-20 Member  
American Medical Student Association
- 2014- Student Member  
American Association for the Advancement of Science
- 2014- Member in Training  
American Society of Clinical Oncology
- 2013- Associate Member  
American Association of Cancer Research

### Invited Manuscript Review

- Annals of Blood, 2020
- Biomedicines, 2020
- Member, Review Board, Cancers, 2020
- Cancer Research, AACR Journal 2019
- Journal of Medical Internet Research, JMIR Journal, 2019

### Institutional/Regional

- 2014-20 Trainee Member  
Holden Comprehensive Cancer Center, University of Iowa Carver College of Medicine  
Member of Cancer Immunology and Immunotherapy Program
- 2014-20 Member  
Iowa Medical Society

## Funding Awards

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### Research Funding

#### National

- 2017-20 NIH F30 CA206255 (Principle Investigator)  
Title: The role of paracrine WNT5A/RYK in ErbB2-driven tumorigenesis,  
Award Amount: \$151,150
- 2015-16 American Medical Association Foundation Research Seed Grant (Principle Investigator)  
Title: Paracrine non-canonical Wnt signaling in breast cancer  
Award Amount: \$4,895
- 2014-17 NIH T32 GM007337, University of Iowa, Medical Science Training Program

#### Institutional

- 2017 Oberley Seed Grant for Experiment Therapeutics (Co-Principal Investigator)  
Title: Targeting mismatch repair for immunotherapy in basal-like breast cancer,  
Award Amount: \$20,000

- 2015 Graduate and Professional Student Government Research Grant (Principle Investigator)  
Title: Wnt5a/Ryk axis in breast cancer,  
Award Amount: \$1,460

### Travel Funds

- 2017 Holden Comprehensive Cancer Center Travel Award
- 2015 Graduate and Professional Student Government Travel Award
- 2014 Executive Council for Professional and Graduate Students Travel Award
- 2014 Holden Comprehensive Cancer Center Travel Award

### Other Funds

- 2015 Carver College of Medicine Curriculum Improvement, Award Amount: \$5000

## Recognitions

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### Research Awards

- 2021 Paul E. Strandjord Young Investigator Award  
Academy of Clinical and Laboratory Physicians and Scientists
- 2020 Williams L. Roberts Young Investigator Award with Distinction  
Academy of Clinical and Laboratory Physicians and Scientists
- 2018 Finalist, Graduate Research Excellence Award in Biological Sciences  
Vice President of Research and Economic Development, University of Iowa
- 2017 Richard G. Lynch, MD Award for Pathology, Medical Student Research Day  
Carver College of Medicine, University of Iowa
- 2017 Research Poster Award Winner, Holden Comprehensive Cancer Center Annual Retreat  
University of Iowa Hospitals and Clinics
- 2017 External Fellowship Supplemental Award  
University of Iowa, Carver College of Medicine
- 2016 Member, ProQuest Hall of Scholars
- 2015 Distinguished Thesis Award, Biological/Life Science  
Midwestern Association of Graduate Schools
- 2015 L.B. Sims Outstanding Master's Thesis Award in Biological Sciences  
Graduate College, University of Iowa
- 2015 Richard G. Lynch, MD Award for Pathology, Medical Student Research Day  
Carver College of Medicine, University of Iowa
- 2015 AAAS/Science Program for Excellence in Science Nominee
- 2014 Richard G. Lynch, MD Award for Pathology, Medical Student Research Day  
Carver College of Medicine, University of Iowa
- 2013 Research Poster Award Winner, Holden Comprehensive Center Annual Retreat  
University of Iowa Hospitals and Clinics
- 2012 Departmental Scholarly Achievement Award  
College of Human Sciences, Iowa State University
- 2011 Louise Rosenfeld Undergraduate Research Internship  
College of Human Sciences, Iowa State University

### Academic Awards

- 2020 Teaching Distinction  
Carver College of Medicine, University of Iowa
- 2020 Special Achievement in Pathology  
Carver College of Medicine, University of Iowa
- 2019 Alpha Omega Alpha Honor Medical Society Induction  
Carver College of Medicine, University of Iowa

- 2018 Hancher-Finkbine Medallion for Leadership, Learning and Loyalty  
University of Iowa
- 2012 Graduated Summa Cum Laude  
Iowa State University
- 2012 University Graduation Marshall  
Iowa State University
- 2012 Graduation Ceremony Student Address  
College of Human Sciences, Iowa State University
- 2011 Cardinal Key Honor Society Induction  
Iowa State University
- 2010 Kappa Omicron Nu Academic Honor Society Induction  
Served as President (2011) and Treasurer (2010)

### Other Awards

- 2018 Wilderness Medicine Race Winner  
Carver College of Medicine, University of Iowa
- 2017 Wilderness Medicine Race Winner  
Carver College of Medicine, University of Iowa
- 2017 Health Science Research Week Cover Art Winner  
Carver College of Medicine, University of Iowa
- 2014 Second Place, Research Challenge Essay Contest  
Carver College of Medicine, University of Iowa
- 2005 Eagle Scout Award

### Military Experience

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#### Sergeant, Infantry

May 2007 – May 2013

United States Marine Corps

- Served in Operation Iraqi Freedom II
- Served as Platoon Sergeant, Squad Leader, Fire Team leader

September 2007 – Sept 2008

#### Promotions:

- 2007 Private First Class (PFC)
- 2008 Lance Corporal
- 2011 Corporal
- 2012 Sergeant

#### Training:

- 2011 Operation Javelin Thrust, Bridgeport, CA
- 2011 Mountain Warfare Training Center, Bridgeport, CA
- 2007 Mojave Viper, 29 Palms, CA
- 2007 School of Infantry, Camp Pendleton, CA
- 2007 Marine Corp Recruit Training, San Diego, CA