Justin Brumbaugh, Ph.D.

Assistant Professor & Boettcher Investigator
Molecular, Cellular, and Developmental Biology

University of Colorado

Academic Positions

	Assistant Professor
2019-present	University of Colorado/BioFrontiers Institute Molecular, Cellular, and Developmental Biology University of Colorado Cancer Center Gates Center for Regenerative Medicine

Education & Training

	NIH/NRSA (F32) Kirschstein Postdoctoral Fellow
2012-2018	Harvard Medical School/Mass. General Hospital Advisor: Konrad Hochedlinger
	NIH Biotechnology Training Program Intern
2011	Max Planck Institute for Biochemistry Advisor: Matthias Mann
	Ph.D. in Biochemistry
2006-2011	University of Wisconsin-Madison Advisors: Joshua Coon & James Thomson
	Fulbright Scholar
2004-2006	European Molecular Biology Lab (EMBL) Advisor: Carsten Schultz
	B.S. in Biochemistry (Honors), Minor in Chemistry
2000-2004	Penn State University Undergraduate thesis advisor: Sarah Ades

Industry Experience

	Research Scientist
2012	Cellular Dynamics International Genome Modification Division

Awards & Honors

2022	ISSCR Lawrence Goldstein Science Policy Fellow
2020	Boettcher Investigator (Webb-Waring Biomedical Research Award)
2019	ISSCR Next Generation Leader
2014-2017	NIH/NRSA (F32) Kirschstein Postdoctoral Fellowship
2014	Tosteson & Fund for Medical Discovery Post-doctoral Fellowship
2010	Baxter Innovation Award
2009-2011	NIH Biotechnology Training Grant
2006-2009	NSF Graduate Research Fellowship
2004-2005	Fulbright Scholar
2004	Wedler Undergraduate Thesis Award
2003	Pfizer Undergraduate Research Scholarship
2003	Arthur Glenn Undergraduate Research Scholarship
2000-2004	Schreyer Honors Scholar

Contact

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Research

My lab develops novel and innovative tools to manipulate cell fate. Our research leverages unique aspects of stem cell biology and induced reprogramming to uncover mechanistic determinants of development and homeostasis. We apply these systems in both murine and human models with the ultimate goal of driving basic science and regenerative medicine.

Areas of Expertise

- Pluripotency
- Chromatin modifications
- Epigenetics
- Proteomics
- Stem cell biology
- RNA processing

Professional Activities and Memberships

- International Society for Stem Cell Research (ISSCR)
- ISSCR Policy Committee
- Gates Center for Regenerative Medicine
- CU Cancer Center
- CU Medical Scientist Training Program
- Univeristy of Colorado Signaling and Cellular Regulation Training Program

Publications (36 total peer reviewed publications; *equal contribution;†corresponding author)

(1) Pashos, A.R.S., Meyer, A.R., Bussey-Sutton, C., O'Connor, E.S., Coradin, M., Coulombe, M., Riemondy, K.A., Potlapelly, S., Strahl, B.D., Hansson, G.C., Dempsey, P.J.*, **Brumbaugh, J.†*** H3K36 methylation regulates cell plasticity and regeneration in the intestinal epithelium. ***Nat. Cell Bio.*** In press.

(2) Levin-Ferreyra, F., Kodali, S., Cui, Y., Pashos, A., Pessina, P., **Brumbaugh, J.**, Di Stefano, B. Transposable element activity captures human pluripotent cell states. EMBO Reports. 2024. PMID: 39668246

(3) Serdyukova, K., Swearingen, A.R., Coradin., M., Nevo, M., Tran, H., Bajric, E., **Brumbaugh, J.†** Leveraging dominant-negative histone H3 K-to-M mutations to study chromatin during differentiation and development. Development. 150(21), 2023. PMID: 37846748

(4) **Brumbaugh, J.†**, Aguado, B.A., Lysaght, T., Goldstein, L.S.B. Human fetal tissue is critical for biomedical research. Stem Cell Reports. 2023. PMID: 37977142

(5) Scott, A.K., Casas, E., Schneider, S.E., Swearingen, A.R., Van Den Elzen, C.L., Seelbinder, B., Barthold, J.E., Kugel, J.F., Stern, J.L., Foster, K.J., Emery, N.C., **Brumbaugh, J.**, Neu, C.P. Mechanical memory stored through epigenetic remodeling reduces cell therapeutic potential. ***Biophysical Journal***. 122(8), 2023. PMID: 36871159

(6) Witkowski, M.T., Lee, S., Wang, E., Lee, A.K., Talbot, A., Ma, C., Tsopoulidis, N., **Brumbaugh, J.**, Zhao, Y., Roberts, K.G., Hogg, S.J., Nomikou, S., Ghebrechristos, Y.E., Thandapani, P., Mullighan, C.G., Hochedlinger, K., Chen, W., Abdel-Wahab, O., Eyquem, J., Aifantis, I. NUDT21 limits CD19 levels through alternative mRNA polyadenylation in B cell acute lymphoblastic leukemia. ***Nature Immunology***. 23(10), 2022. PMID: 36138187

(7) Seelbinder, B., Ghosh, S., Schneider, S.E., Scott, A., Berman, A.G., Goergen, C.J., Margulies, K.B., Bedi, K., Casas, E., Swearingen, A.R., **Brumbaugh, J.**, Calve, S., Neu, C.P. Nuclear Deformation Guides Chromatin Reorganization in Cardiac Development and Disease. ***Nature Biomedical Engineering***. 5(12), 2021. PMID: 34857921.

(8) **Brumbaugh, J.*†,** Di Stefano, B.*, Sardina, J.L.*, Chromatin Regulation in Cell Fate Decisions. ***Frontiers in Cell and Developmental Biology***. 9, 2021. PMID: 34540846

(9) **Brumbaugh, J.**, Di Stefano, B., Hochedlinger, K. Reprogramming: identifying the mechanisms that safeguard cell identity. ***Development***. 146(23), 2019. PMID:31659274

(10) **Brumbaugh, J.***, Soo Kim, I.*, Ji, F., Huebner, A.J., Di Stefano, B., Schwarz, B.A., Charlton, J., Coffey, A., Choi, J., Walsh, R.M., Schindler, J.W., Anselmo, A., Meissner, A., Sadreyev, R.I., Bernstein, B., Hock, H.*, Hochedlinger, K.* Inducible histone K-to-M mutations are dynamic tools to probe the physiological role of site-specific histone methylation in vitro and in vivo. ***Nat. Cell Bio.*** 21(11), 2019. PMID:31659274

(11) Di Stefano, B., Luo, E.C., Haggerty, C., Aigner, S., Charlton, J., **Brumbaugh, J.,** Ji, F., Rabano Jiménez, I., Clowers, K.J., Huebner, A.J., Clement, K., Lipchina, I., de Kort, M.A.C., Anselmo, A., Pulice, J., Gerli, M.F.M., Gu, H., Gygi, S.P., Sadreyev, R.I., Meissner, A., Yeo, G.W., Hochedlinger, K. The RNA Helicase DDX6 Controls Cellular Plasticity by Modulating P-Body Homeostasis. ***Cell Stem Cell***. 25(5), 2019. PMID:31588046

(12) Schiebinger, G., Shu, J., Tabaka, M., Cleary, B., Subramanian, V., Solomon, A., Gould, J., Liu, S., Lin, S., Berube, P., Lee, L., Chen, J., **Brumbaugh, J.**, Rigollet, P., Hochedlinger, K., Jaenisch, R., Regev, A., Lander, E.S. Optimal-Transport Analysis of Single-Cell Gene Expression Identifies Developmental Trajectories in Reprogramming. ***Cell***. 176(4), 2019. PMID:30712874

(13) Sardina, J.L., Collombet, S., Tian, T.V., Gómez, A., Di Stefano, B., Berenguer, C., **Brumbaugh, J.**, Stadhouders, R., Segura-Morales, C., Gut, M., Gut, I.G., Heath, S., Aranda, S., Di Croce, L., Hochedlinger, K., Thieffry, D., Graf, T. Transcription Factors Drive Tet2-Mediated Enhancer Demethylation to Reprogram Cell Fate. ***Cell Stem Cell***. 23(5), 2018. PMID:30220521

(14) Di Stefano, B., Ueda, M., Sabri, S., **Brumbaugh, J.**, Huebner, A.J., Sahakyan, A., Clement, K., Clowers, K.J., Erickson, A.R., Shioda, K., Gygi, S.P., Gu, H., Shioda, T., Meissner, A., Takashima, Y., Plath, K., Hochedlinger, K. Reduced MEK inhibition preserves genomic stability in naive human embryonic stem cells. ***Nature Methods***. 15(9), 2018. PMID:30127506

(15) **Brumbaugh, J.***, Di Stefano, B.*, Wang, X., Borkent, M., Forouzmand, E., Clowers, K.J., Schwarz, B.A., Kalocsay, M., Elledge, S., Gygi, S.P., Hu, G., Yongsheng, Y., Hochedlinger, K. Nudt21 controls cell fate by connecting alternative polyadenylation to chromatin signaling. ***Cell***. 172(1-2), 2018. PMID:29249356

Publications (continued)

(16) Choi, J., Huebner, A.J., Clement, K., Walsh, R.M., Savol, A., Lin, K., Gu, H., Di Stefano, B., **Brumbaugh, J.**, Kim, S., Sharif, J., Rose, C.M., Mohammad, A., Odajima, J., Charron, J., Shioda, T., Gnirke, A., Gygi, S.P., Koseki, H., Sadreyev, R., Xiao, A., Meissner, A., Hochedlinger, K. Prolonged Mek1/2 suppression impairs the developmental potential of embryonic stem cells. ***Nature***. 548(7666), 2017. PMID:28746311

(17) Choi, J., Clement, K., Huebner, A.J., Webster, J., Rose, C.M., **Brumbaugh, J.**, Walsh, R.M., Lee, S., Savol, A., Etchegaray, J.P., Gu, H., Boyle, P., Elling, U., Mostoslavsky, R., Sadreyev, R., Park, P.J., Gygi, S.P., Meissner, A., Hochedlinger, K. DUSP9 modulatesDNA hypomethylation in female mouse pluripotent stem cells. ***Cell Stem Cell***. 20(5), 2017. PMID:28366588

(18) Liu, L.L., **Brumbaugh, J.**, Bar-Nur, O., Smith, Z., Stadtfeld, M., Meissner, A., Hochedlinger, K., Michor, F. Probabilistic Modeling of Reprogramming to Induced Pluripotent Stem Cells. ***Cell Reports***. 17(12), 2016. PMID:28009305

(19) Borkent, M., Bennett, B.D., Lackford, B., Bar-Nur, O., **Brumbaugh, J.**, Wang, L., Du, Y., Fargo, D.C., Apostolou, E., Cheloufi, S., Maherali, N., Elledge, S.J., Hu, G., Hochedlinger, K. A Serial shRNA Screen for Roadblocks to Reprogramming Identifies the Protein Modifier SUMO2. ***Stem Cell Reports***. 6(5), 2016. PMID:26947976

(20) Cheloufi, S., Elling, U., Hopfgartner, B., Jung, Y.L., Murn, J., Ninova, M., Hubmann, M., Badeaux, A.I., Ang, C.E., Tenen, D., Wesche, D.J., Abazova, N., Hogue, M., Tasdemir, N., **Brumbaugh, J.**, Rathert, P., Jude, J., Ferrari, F., Blanco, A., Fellner, M., Wenzel, D., Zinner, M., Vidal, S.E., Bell, O., Stadtfeld, M., Chang, H.Y., Almouzni, G., Lowe, S.W., Rinn, J., Wernig, M., Aravin, A., Shi, Y., Park, P.J., Penninger, J.M., Zuber, J., Hochedlinger, K. The histone chaperone CAF-1 safeguards somatic cell identity. ***Nature***. 528(7581), 2015. PMID:26659182

(21) Bar-Nur, O., Verheul, C., Sommer, A.G., **Brumbaugh, J.**, Schwarz, B.A., Lipchina, I., Huebner, A.J., Mostoslavsky, G., Hochedlinger, K. Lineage conversion induced by pluripotency factors involves transient passage through an iPS cell stage. ***Nature Biotechnology***. 33(7), 2015. PMID:26098450

(22) Bar-Nur, O.*, **Brumbaugh, J.***, Verheul, C., Apostolou, E., Pruteanu-Malinici, I., Walsh, R.M., Ramaswamy, S., Hochedlinger, K. Small molecules facilitate rapid and synchronous iPSC generation. ***Nature Methods***. 11(11), 2014. PMID:25262205

(23) Honarpour, N., Rose, C.M., **Brumbaugh, J.**, Anderson, J., Graham, R.L.J., Sweredoski, M.J., Hess, S., Coon, J.J., Deshaies, R.J. F-box Protein FBXL16 Binds PP2A-B55α and Regulates Differentiation of ES Cells along the FLK1+ Lineage. ***Mol Cell Proteomics***. 13(3), 2014. PMID:24390425

(24) **Brumbaugh, J.***, Russell, J.D.*, Yu, P., Westphall, M.S., Coon, J.J., Thomson, J.A. NANOG is multiply phosphorylated and directly modified by ERK2 and CDK1 in vitro. ***Stem Cell Reports***. 2(1), 2014. PMID:24678451

(25) **Brumbaugh, J.**, Hochedlinger, K. Removing reprogramming roadblocks: Mbd3 depletion allows deterministic iPSC generation. ***Cell Stem Cell***. 13(4), 2013. PMID:24094318

(26) Van Etten, J., Schagat, T.L., Hrit, J., Weidmann, C., **Brumbaugh, J.**, Coon, J.J. & Goldstrohm, A.C. Human Pumilio proteins recruit multiple deadenylases to efficiently repress messenger RNAs. ***J Biol Chem***. 287(43), 2012. PMID:22955276

(27) Bailey, D.J., Rose, C.M., McAlister, G.C., **Brumbaugh, J.**, Yu, P., Wenger, C.D., Westphall, M.S., Thomson, J.A. & Coon, J.J. Instant spectral assignment for advanced decision tree-driven mass spectrometry. ***PNAS***. 109(22), 2012. PMID:22586074

(28) **Brumbaugh, J.**, Hou, Z., Russell, J.D., Howden, S.E., Yu, P., Ledvina, A.R., Coon, J.J. & Thomson, J.A. Phosphorylation regulates human OCT4. ***PNAS***. 109(19), 2012. PMID:22474382

(29) **Brumbaugh, J.**, Rose, C.M., Phanstiel, D.H., Thomson, J.A. & Coon, J.J. Proteomics and pluripotency. ***Crit Rev Biochem Mol Biol***. 46(6), 2011. PMID:21999516

(30) Phanstiel, D.H.*, **Brumbaugh, J.***, Wenger, C.D., Tian, S., Probasco, M.D., Bailey, D.J., Swaney, D.L., Tervo, M.A., Bolin, J.M., Ruotti, V., Stewart, R., Thomson, J.A. & Coon, J.J. Proteomic and phosphoproteomic comparison of human ES and iPS cells. ***Nature Methods***. 8(10), 2011. PMID:21983960

(31) McAlister, G.C., Phanstiel, D.H., **Brumbaugh, J.**, Westphall, M.S. & Coon, J.J. Higher-energy collsion-activated dissociation without a dedicated collision cell. ***Mol Cell Proteomics***. 10(5), 2011. PMID:21393638

Laketa, V., Zarbakhsh, S., Morbier, E., Subramanian, D., Dinkel, C., **Brumbaugh, J.**, Zimmermann, P.,

(32) Pepperkok, R. & Schultz, C. Membrane-permeant phosphoinositide derivatives as modulators of growth factor signaling and neurite outgrowth. ***Chem Biol***. 16(11), 2009. PMID:19942142

Publications (continued)

(33) **Brumbaugh, J.**, Phanstiel, D. & Coon, J.J. Unraveling the histone's potential: a proteomics perspective. ***Epigenetics***. 3(5), 2008. PMID:18849650

(34) Phanstiel, D., **Brumbaugh, J.**, Berggren, W.T., Conard, K., Feng, X., Levenstein, M.E., McAlister, G.C., Thomson, J.A. & Coon, J.J. Mass spectrometry identifies and quantifies 74 unique histone H4 isoforms in differentiating human ES cells. ***PNAS***. 105(11), 2008. PMID:18326628

(35) **Brumbaugh, J.**, Schleifenbaum, A., Stier, G., Sattler, M. & Schultz, C. Single- and dual-parameter FRET kinase probes based on pleckstrin. ***Nature Protocols***. 1(2), 2006. PMID:17406341

(36) **Brumbaugh, J.**, Schleifenbaum, A., Gasch, A., Sattler, M. & Schultz, C. A dual parameter FRET probe for measuring PKC and PKA activity in living cells. ***J Am Chem Soc***. 128(1), 2006. PMID:16390103

Teaching and Mentorship

Teaching experience:

2020-2024	MCDB 4650: Developmental Biology
2020-2024	MCDB 5230: Graduate Core (Co-taught)
2020	BCHM 5801: Advanced Topics in Signaling Transduction & Cellular Regulation (Co-Taught)
2020-2024	Responsible Conduct of Research (Guest Instructor)
2012	Guest lecturer-BIOCHEM 703: Methods in Biochemistry
2011	Counselor-Wisconsin Summer Science Camp
2007	Guest lecturer-CHEM 329: Fundamentals of Analytical Chemistry
2006-2007	Teaching Assistant-BIOCHEM 507: General Biochemistry
2004	Teaching Assistant-KINES 004: Principles of Fly Tying and Fly Fishing for Trout
2003-2004	Teaching Assistant-BMB 401: General Biochemistry

Graduate student mentorship:

2023	Pauline Reimer (M.S. student: part of the University of Regensburg/CU exchange program)
2023-present	Erin O'Connor (PhD student)
2021-present	Mika Nevo (PhD student)
2019-2024	Alison (Swearingen) Pashos (Graduated 2024 PhD; Gordon Stone Graduate Scholarship)
2016-2017	Shona Robinson (M.S. student), currently Senior Associate Scientist at ElevateBio

Postdoctoral trainee mentorship:

2024	Alison (Swearingen) Pashos, currently senior Scientist II at Lincswitch Therapeutics
2023-present	Deirdre Logsdon
2021-2023	Mariel Coradin, currently Scientist at Corgenix Medical Corporation
2021-2023	Eduard Casas, currently Bioinformatics Scientist at Watchmaker Genomics
2020-2022	Steven Guard, currently Senior Scientist at Strategic Analysis Inc.

Undergraduate student mentorship:

2024-present	Kindyll Wetta
2024-present	Bo Thorstenson
2024-present	Samantha Patten
2023-2024	Daniel Martins (Uplift student through STEM Routes, UROP Scholarship for summer 2024)
2023-2024	Lynae Smith (UROP Scholarship 2024-2025 academic year)
2022-2023	Valarie Finck
2022-2023	Nova Jones (Uplift student through STEM Routes)
2022-2023	Sanjana Potlapelly (UROP Schoarship for summer 2023)
2021-2022	Huong Tran (graduated magna cum laude with an honors thesis)
2019-2023	Emir Bajric (UROP Scholarship for summer 2021)
2019-2021	Meghan Skalicky (graduated summa cum laude with an honors thesis, BSI Scholar)
2019-2020	Emily Czarnik

Thesis committees:

2019-present	I have served on 31 graduate and 4 undergraduate thesis committees across multiple departments (Molecular, Cellular, and Developmental Biology; Biochemistry; Mechanical Engineering; Materials Science, Engineering, and Pediatrics (CU Anschutz)).

Science Policy

2023-2024	Representative for the International Society for Stem Cell Research Congressional Advocacy day (Meet with congressional staff regarding fetal tissue research and science funding)
2022-present	International Society for Stem Cell Research Policy Committee